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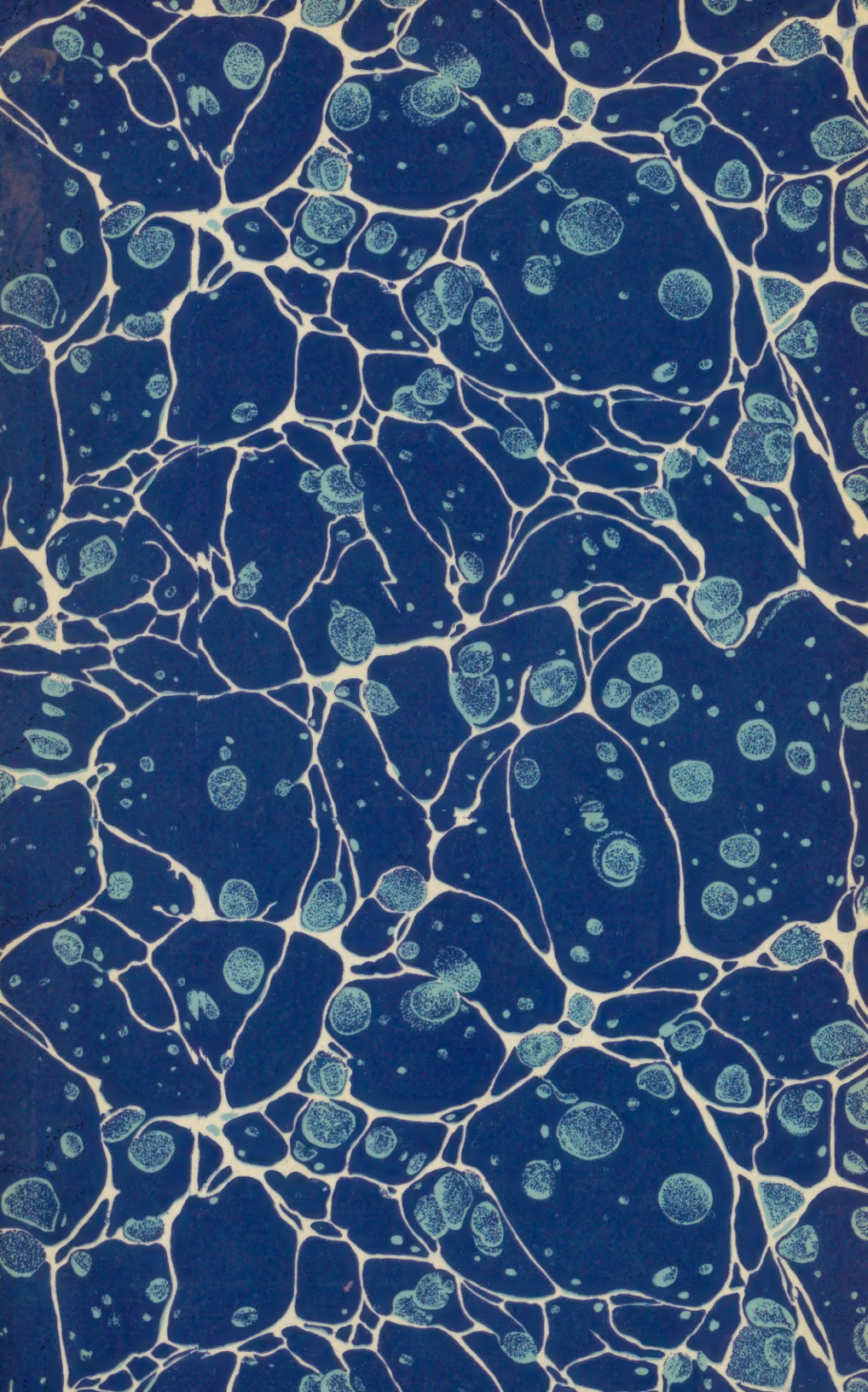
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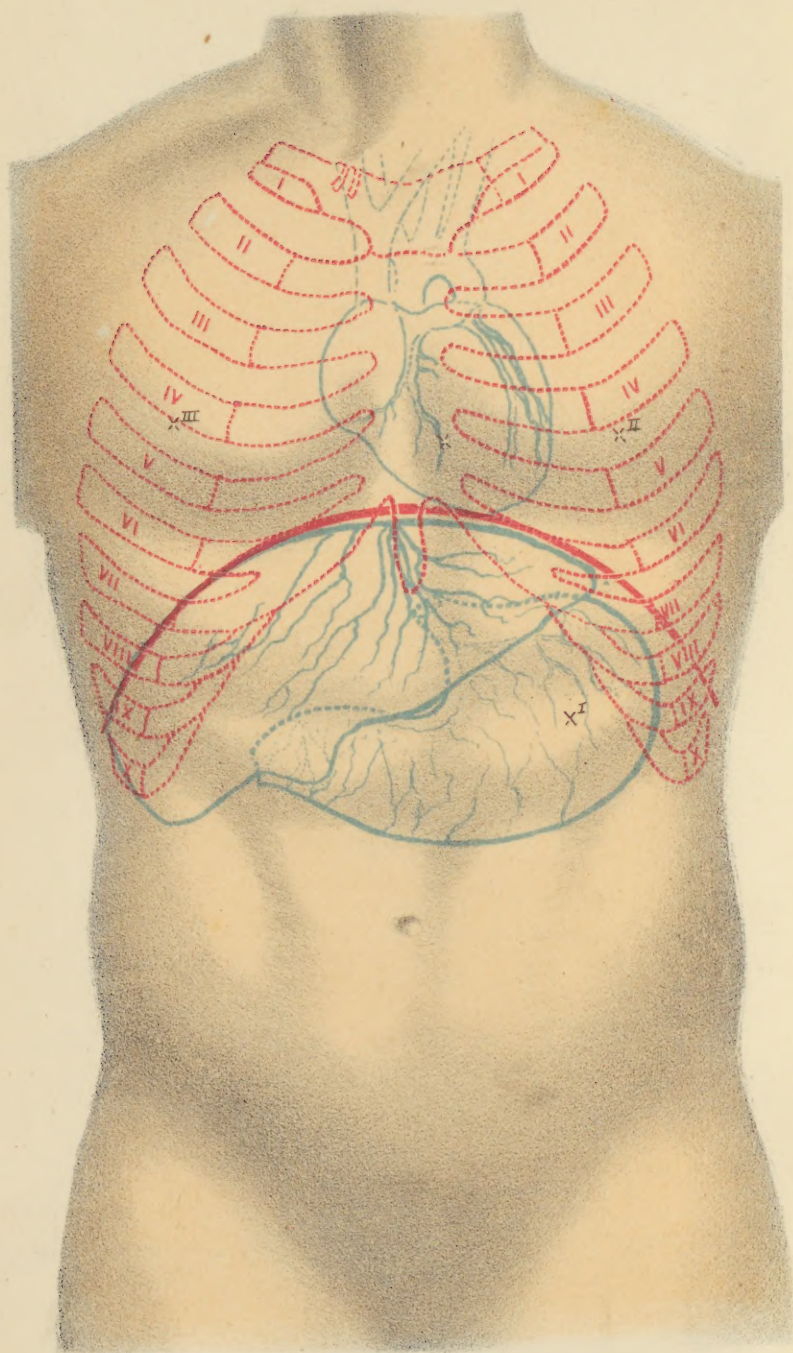
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PLATE I.



PHARMACEUTICAL, ANATOMICAL AND CHEMICAL LEXICON.

THE
NATIONAL FUNERAL DIRECTORS'
OFFICIAL TEXT BOOK,

EMBRACING :

A DICTIONARY OF PHARMACEUTICAL SCIENCE WITH A CONCISE EXPLANATION OF THE
VARIOUS SUBJECTS AND TERMS OF PHARMACY, ANATOMY, PHYSIOLOGY
AND CHEMISTRY, SO FAR AS THEY APPLY TO THE PRESERVATION
OF THE HUMAN BODY, WITH ALL THE METHODS IN
USE FOR THE PRESERVATION OF THE DEAD
THROUGHOUT THE WORLD.

PUBLISHED UNDER THE AUSPICES OF THE

National
Funeral Directors' Association of the United States (and Canada.)

"A WORK THAT IS MODERN AND RELIABLE AS A STANDARD."

COMPILED FROM THE MOST RELIABLE SOURCES BY

H. SAMSON, Esq., *President of the National Funeral Directors' Association,*
O. N. CRANE, *Ex-President of the National Funeral Directors' Association,* COMMITTEE.
A. B. PERRIGO, *Secretary of the National Funeral Directors' Association,*

ASSISTED BY

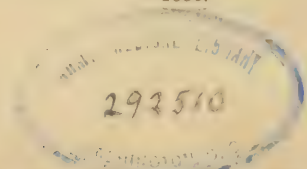
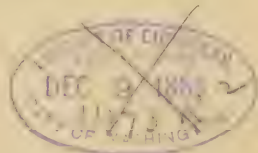
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Chicago Medical College.

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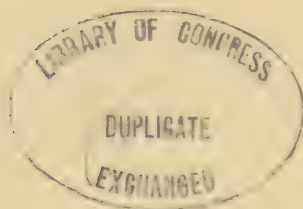
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COPYRIGHT,
1886,
BY A. B. PERRIGO,



TO THE MEMORY
OF
THE UNKNOWN EMBALMER,

BY WHOSE KNOWLEDGE AND SKILL, FOR MORE THAN THREE THOUSAND YEARS THE
BODY OF RAMESES II.—THE PHAROAH, WHOSE DAUGHTER ADOPTED MOSES—
HAS BEEN SO PERFECTLY PRESERVED THAT IT IS POSSIBLE HERE-
WITH TO PRESENT TO THE READERS OF THIS BOOK
A PHOTO-ENGRAVING OF THE SAME.



RAMESES II. (1404-1341 B.C.).

“After the lapse of thirty-three centuries, the face of him who made the lives of the Hebrews bitter, with hard service in mortar and brick, still preserves the haughty features of one from whose anger Moses can readily be believed to have fled into Midian.”—*Graphic*, July 1886.

PREFACE.

AT the meeting of the National Funeral Directors' Association held in Washington, October, 1885, a committee was appointed to prepare a "set of text-books that will embrace education, mechanical art, floral art, etiquette, law of the different states in regard to funerals, shades and shadows, fabrics and fraternal courtesy, how to organize a local, or county association, with by-laws and constitution, the toilet and dress of a funeral director with full instruction in regard to the professional duties of a funeral director and his assistants." Also a "dictionary of pharmaceutical science, with a concise explanation of the various subjects and terms of pharmacy, anatomy, physiology and chemistry, so far as they apply to the preservation of the human body, with all the methods in use for the preservation of the dead throughout the world—a work that will be modern and reliable as a standard." (Official records, fourth annual convention, pages 53, 54.) In accordance with the above the undersigned committee, after due study of the scope of such a work as contemplated in the last clause of the report, have prepared with the aid of the best talent in its various departments a compendium especially adapted to the needs of the progressive funeral director.

The need of such a handbook is fully demonstrated by the numerous imperfect works of this character put upon the market by the various manufacturers of funeral supplies. None of these, however, have been projected upon the encyclopedic character and liberal outlay of the present work, on which, as a representative of the national association, no pains, or expense, have been spared to make it as nearly perfect as possible in all its parts. Each section constitutes a book of great value to the profession, and conjointly they represent the essentials of a rare and expensive professional library such as would be hardly possible for one to possess, however much he might desire it.

In the preparation of this work, in addition to the assistance mentioned upon the title page, the committee has been materially aided by Dr. G. Brown Goode of the National Museum, and Dr. D. S. Lamb of the United States Naval Museum at Washington, Dr. Peter H. Bryce of Toronto, Canada; and Prof. J. T. Hatfield of Evanston, to the last of whom the Lexicon owes much of its value.

The official Text-Book being exactly what it purports to be, a col-

lection from all available sources of the facts necessary for the proper performance of the embalmer's art, the compilers lay no claim to originality of composition. They have gathered freely from the common fund of scientific knowledge whatever seemed to them of value or of interest to the progressive undertaker, and in so doing have endeavored to give credit whenever it was honestly due, without at the same time burdening the work with a multitude of cross references. In this connection we desire especially to acknowledge the frequent use that has been made in the preparation of Section III. of Gorup-Besanez's "Physiological Chemistry," and Prof. Victor C. Vaughan's Chemical Physiology, without which it could scarcely have been written. Nor ought we to forget here to mention the invaluable assistance of our artist, William Ottmann of Chicago, who cheerfully reproduced his original drawings after their destruction by fire, and by his indefatigable care and fine artistic ability has succeeded in illustrating this work with what we unhesitatingly claim to be the finest and most accurate anatomical chromo lithographs yet produced in America.

H. SAMSON,
O. N. CRANE,
A. B. PERRIGO,
Committee.

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SECTION I.

A BRIEF HISTORICAL ACCOUNT
OF THE
VARIOUS METHODS ADOPTED
FOR THE
DISPOSAL OF THE DEAD.

- I. EXPOSURE.
- II. CREMATION.
- III. INHUMATION.
- IV. EMBALMING.

MODES OF BURIAL.

A BULKY volume could easily be written on the ceremonies observed at the time of death and burial by the various tribes and races of the world, civilized and uncivilized. Nothing that human ingenuity can devise, or affection suggest, has been left undone to express grief at the loss of the dead, or to provide for their future welfare. At such times grief finds public expression in fasting, unkempt hair, rags, sackcloth and ashes, or daubing the body with dust and pigments. Mutilation of the body is also an exceedingly frequent practice among barbarous nations whether done by cutting, as of old in Canaan, or as is practiced in New Zealand and in the East Indies at the present day.

Cutting off fingers and toes, knocking out teeth (Hawaiians), or even suicide are considered the highest marks of respect that can be paid to the dead by savage tribes. Among almost all of these nations sacrifices of one kind or another are also offered in honor of the dead. These consist of provisions of the most varied character, meat, drink, weapons, favorite horses, dogs, servants, and wives. All of these customs are practiced either with the hope that the deceased may make use of these objects in a future world, or that malevolent spirits may be propitiated by costly gifts. Thus understood, they are frequently exceedingly touching and beautiful, as when the Laplander places flint, tinder and steel by his dead to furnish him fire and light in another world, or when the Chipewea kindles fires nightly to light the spirits on their way, or the Pomernian places straw in the graveyard to serve as resting places for the spirit wearied by its long travel. With the same thought many of the North American Indians present their dead with moccasins and even bits of deer skin and needles to patch them with, lest their shoes should wear out on the long journey, and in Greenland it is the custom to bury with a little child a dog also, because they say a dog will find his way anywhere, and the Arabs with similar intention leave a camel to die over the grave of a friend.

The sacrifice of horses, dogs, and slaves at the death of a king sometimes reaches to hundreds in Africa. In Dahomey it is said that these sacrifices are often kept up for an entire year. Until very recent times even in so enlightened a country as Japan, it was the custom to order twenty or thirty slaves to commit hari-kari at the death of the nobleman

to whose estate they happened to be attached, and friends are no better off in Fiji, where it is the correct thing for them to be strangled along with the wives and slaves of the deceased.

Wife-burning at present is confined to the Dark Continent, but at one time it was the almost universal custom among eastern nations and until comparatively recent times was largely practiced in Hindoostan. *Suttee*, as it is there named, has been broken up only by the most stringent laws on the part of the English government during the past thirty years. Before that time the widow was expected to dress herself in her finest clothes and lie down by the side of her deceased husband on the funeral pile, where she was securely tied with ropes. The eldest son of the dead man then came forward with a torch and applied it to the pyre which had been saturated with oil so as to make it burn quickly. As the flames arose, the crowd raised a great shout, and the noise of drums was added, ostensibly in honor of the heroism of the woman, but really to drown her cries. The Quakeolith Indians practice semi-suttee, so to speak, for the wife is tied to the stake at which her husband is cremated, where she is left until half roasted, being dragged away just in time to save her life. Among many savage tribes the burial of women is different from that of the men, among the Colchicans, for instance, the women were buried and the corpses of the men suspended in the trees, and the Ghonds burn their men and bury their women. The Bongas bury men with their faces to the north and women with their faces toward the south, for some inexplicable reason, for many of these burial customs can be as little explained as the practice of the Greenlanders of taking the corpse through a window, or the Siamese through a newly-made hole in the wall. Others are simply puerile, as the old Egyptian custom of turning the corpse around many times to make it so giddy that it should not know where it was going, or the habit of the Australians of pulling out the nails, lest the body should scratch its way back to earth again. The use of money—from the obolus of the Greeks to the millions recently lavished by the monarchs of Burmah—passports, sacrifices and masses for the repose of the dead are so varied in character that it would be useless here to discuss them in detail, for the object of this work is not properly a consideration of funeral rites and ceremonies, but of the various methods adopted for the final disposal of the dead. From the first death to the present time mankind has been forced perpetually to consider this question, but as yet his ingenuity has devised but five methods, to wit:

1. EXPOSURE.
2. NECROPHAGISM.
3. CREMATION.
4. INHUMATION.
5. EMBALMING.

[1.] AERIAL AND OTHER EXPOSURE.

Aerial Suspension was practiced by the ancient Scythians, who placed the dead body upon a carriage and carried it about to their different acquaintances, who prepared a feast for the corpse and its attendants, the dead body being served exactly as the others. The body must have been embalmed, for it was thus carried about, as a rule, for forty days, and then interred, although some suspended their dead from trees and left them thus to putrefy, thinking with Plutarch, "Of what consequence is it, whether one rots in the earth or upon it?" And history repeats itself, for today the savages of New Holland hang their corpses in baskets on the trees, and leave them to the fate of the Colchican dead, who, as history tells us, were in former times also suspended from the trees.

Aerial sepulture, according to Dr. Yarrow, is one of the methods adopted by the North American Indians, and certain tribes use for this purpose lodges on a platform, or an elevated tent constructed of buffalo hides and brush. Others employ coffins, or canoes, raised from the earth on scaffolds.

Surface burial, or direct exposure, is now resorted to only by the rudest tribes, who either leave their dead where they die, like the Caffirs, and move their camps to new locations, or, like the more savage Wanyamwesi, carry their dying into the forest and there leave them. In Zanzibar only those dying in battle are left thus exposed, and in the Sahara from necessity this is often the only resource. Hardly different is the custom of the Moors, who lightly cover the body with stones, or, where these are wanting, simply with a heap of prickly thorns. To a limited extent this is also employed by some of the North American Indians.

[2.] NECROPHAGISM,

To coin a word, is here employed to include all methods by which the aid of wild beasts, birds, or fishes, is utilized in the disposal of the dead. Under this head should also be included *cannibalism* or the Calatian fashion of eating one's deceased friends, for it is said by Herodotus that "the Calatians being asked by Darius on what terms they would consent to burn the bodies of their parents, burst into tears and begged the king to inform them why he thought they were so deficient in reverence to their honored parents as to suppose that they would do otherwise than to eat their hallowed remains."

Akin to these was Queen Artemisia, who is said to have mingled the ashes of her beloved Mausoleus with wine and drank it as a mark of affection. The aboriginal Australians use, like the ancient Norsemen, the skulls of their deceased warriors as drinking cups, and to this day certain of the African tribes grind the bones of their dead, and in accordance

with the most advanced physiology, mingle them with their food. History tells us that the Balearians made the same final disposition of their dead, whom they first chopped and potted. (Strother.) And recent African travelers report that the unfortunate priests in Dahomey are required to eat, or pretend to eat, the bodies of those who have been killed by lightning. A similar duty falls to the lot of the priests in Tartary where the very wealthy are sometimes burnt with great solemnity, after which the ashes are made into cakes and eaten by the priests.

Aquatic burial, or the destruction of the body by the aid of water and fishes, is comparatively rare, but it was practiced by the ancient Ichthyophagi, whom Herodotus says placed their dead in the sea, hoping thus to get rid at the same time of the corpse and its ghost as well. The Oronoco Indians prepare their corpses for burial by fastening the body with a rope to a tree near a river, into which they drop the body for twenty-four hours, in which time the voracious fishes completely skeletonize it by eating the flesh away from the bones.

Perhaps, under this same head, we ought to include the practice of the inhabitants of the Island of Coos, whose custom was to burn their dead, pulverize their ashes, and then cast them into the sea. The Indians of our own country at times resort to aquatic burial, depositing the corpse in a canoe, which they set afloat on some lake or stream remote from their habitations, for they are very careful not to pollute thus any water they may use for drinking purposes.

The destruction of the dead by means of *wild beasts* was not a very unusual practice in former times, for the Parthians, Medes, Iberians and Caspians had such a horror of the corruption and decomposition of the dead, and of their being eaten by worms, that they threw the bodies into the open fields to be devoured by wild beasts, believing that those so devoured would not be entirely annihilated, but enjoy a partial life in their living sepulchres. The Bactrians kept dogs for this especial purpose, and in Thibet there is said to be a sacred race of puppies preserved for the same use. Dogs are similarly utilized by the Kamtchatkans, who take special comfort in this practice, from the fact that they believe that all those eaten by dogs here will hereafter drive fine ones in the other world.

The careless method of surface burial resorted to by the Moham-medans in Eastern countries really resolves itself into the dead being devoured by wild dogs and jackals, but the only people who now publicly employ wild beasts for this purpose are the Parsees or the descendants of the ancient Persians, who threw out their dead on the roads, and if promptly devoured by the wild beasts, it was esteemed a great honor. If this did not happen, it was a great misfortune, for they believed that one must have been very bad if even the beasts refused to touch them, and

the relatives of the dead took it as a presage of some great misfortune which was imminent, thinking that the souls which had inhabited the bodies, being dragged down to hell, would not fail to return and trouble them.

PARSEE BURIAL.

The modern Parsees expose the bodies of their dead to be devoured by vultures, because they consider this method most appropriate and satisfactory, for, in accordance with Zoroaster's teachings, they consider fire too sacred to be put to any such ignoble use, and the burial of the dead is a defilement and an injury to the earth, whom they consider the mother of mankind.

The methods adopted by them for this purpose are so unusual that we feel at liberty to quote somewhat at length from Prof. Monier Williams' account of the Towers of Silence, as they are called, located at Calcutta :

" No English nobleman's garden could be better kept, and no pen can do justice to the glories of its flowering shrubs, cypresses and palms. It seemed the very ideal, not only of a place of sacred silence, but of peaceful rest. The towers are five in number, of black granite, and constructed with great solidity. The oldest was built 200 years since, and is the smallest, being used only for a certain family. The next oldest was erected in 1756, the others later. Though wholly destitute of ornament and even the simplest moldings, the parapet of each tower possesses an extraordinary coping, which instantly attracts and fascinates the gaze. It is a coping formed, not of dead stone, but of living vultures. These birds, on the occasion of my visit, had settled themselves, side by side, in perfect order and in a complete circle around the parapets of the towers, with their heads pointing inwards ; and so lazily did they sit there, and so motionless was their whole mien, that, except for their color, they might have been carved out of the stone work.

" One of the towers is a round column, or massive cylinder, twelve or fourteen feet high, and at least forty feet in diameter, built of solid stone, except in the center, where a well five or six feet across leads down to an excavation under masonry, with four drains at right angles to each other, terminated with holes filled with charcoal. Round this solid cylinder is the stone parapet, ten or twelve feet high, which conceals the interior. The upper surface of the solid stone work is divided into seventy-two compartments, or open receptacles, radiating like the spokes of a wheel from the central wall, and arranged in three concentric rings, separated by narrow ridges of stone, grooved to act as channels for conveying all moisture from the receptacles into the well, and thus to the lower drains. Each circle of the open compartments is divided from the next by a pathway, making three circular pathways, and these crossed by

another conducting from the exterior door which admits the corpse-bearer. While engaged in examining the work, a sudden stir among the vultures made us raise our heads. At least a hundred birds, collected around one of the towers, began to show symptoms of excitement, while others swooped down from the neighboring trees. A funeral was seen to be approaching. The body, swathed in a white sheet, is placed in a curved metal trough, open at both ends, and the corpse-bearers, dressed in pure white garments, proceeded with it towards the towers. The funeral I witnessed was that of a child. When the two corpse-bearers reached the path leading by a steep incline to the door of the tower, the mourners, about eight in number, turned back and entered one of the prayer houses. The two bearers speedily unlocked the door, reverently conveyed the body of the child into the interior, and, unseen by any one, laid it uncovered in one of the receptacles nearest the central wall. In two minutes they reappeared with the empty bier and white cloth, and scarcely had they closed the door, when a dozen vultures swooped down upon the body and were rapidly followed by others. In five minutes more the satiated birds fly back and lazily settle down again on the parapet. They had left nothing behind but a skeleton."

In Siam a similar practice is sometimes adopted, but it there is reserved for the very poorest, whose flesh is cut from their bones and thrown to the birds to be devoured. The general custom, however, of the Siamese, as with the majority of the Eastern nations, where the family can afford it, is

[3.] CREMATION.

This, according to Dr. Ericksen, practiced from the earliest times by the inhabitants of the interior of Asia, by the Thracians, Celts, and others, is now the universal custom among the Siamese, Burmese, Cambogians and Peguans. So general is the custom among these latter people that a cemetery is almost unknown to them, for only their very poor, or those too close to pay the requisite fees, are ever buried. The Siamese first embalm, after an imperfect fashion, removing only the intestines, and place the body in coffin, where it is kept in state four, six, thirty days—never longer, according to the rank of the family, the latter period being allowed only to the very wealthy. During the time the body lies in state it is attended by the relatives, who make offerings and daily prostrations to it. When at last the time for cremation arrives, the body is decked with jewelry and is laid in an appropriate receptacle on the summit of a combustible pyramid, upon which almost fabulous amounts of money are expended, if the pyre belongs to the royal family. At the burning, bundles of clothes are thrown over the fire, and mirth and music are at their height, until the combustion is finished, when the

ashes are gathered by the officiating priest into a golden urn, if the family is able to afford it.

HINDOOS.

Among the Hindoos funeral customs do not differ materially from the Siamese. Cremation is the general practice, except with the religious orders who are buried sitting. The body is bathed, perfumed, and decked with flowers, before it is carried to the pyre, which is four to five feet high, strewn with flowers and sprinkled with sweet-smelling oils. Formerly Suttee, or the burning of the widow with the body of her husband, was very generally practiced in India. This arose, not from countenance by native law, but probably from a misunderstanding of some of the passages in their sacred books, one of which says: "She who follows her husband to another world shall dwell in the region of joy for 30,000,000 years, or as many as there are hairs upon the human body." Some thirty years ago the East India Company took energetic measures to suppress this custom. It may be said to have been successfully abolished, although from habit and superstition Suttee still occasionally takes place.

It is the great desire of every Hindoo to die in sight of the river Ganges and to have his ashes carried to the sea by its waters; hence it is the rule to carry those who are very sick to its banks, there to await death in little bamboo huts erected for that purpose. If death is tardy, they pour water on the face of the sick one and fill his mouth with mud to expedite the process, but if he should recover, which sometimes happens, after this ceremony is performed, the friends will not recognize him, and he is ever after treated as an outcast; his property is divided among his heirs, and he is considered legally dead, without any rights whatever. No one will associate with him, and he finds life such a burden that he is usually glad to end his troubles by throwing himself into the river.

The favorite places for incineration are the Burning Ghauts, or stairs, situated upon the borders of the Ganges or its branches, into which the ashes are thrown after cremation. The bodies to be burned are placed on piles of wood, and the torch is applied by one of the relatives of the deceased. If the person is wealthy, there is generally a large assemblage of mourners, some of them being relatives, and others hired for the occasion; all are dressed in white robes of a peculiar pattern, such as are worn only by mourners, and the sounds of lamentation are often very loud and prolonged. But if the deceased individual was poor the ceremony is very brief, and there are no mourners, nor is the funeral pile as large as in the other case.

It is said that formerly the priests used to put out the fires before the bodies were half consumed, in order to save the wood; the remains

were then thrown into the river and floated down among or past the shipping. There were so many complaints of the disagreeable sights forced upon those who were coming up the river, that the government has of late years stationed an officer at the Burning Ghauts to see that the work is properly done, and only the ashes find their way into the Ganges. Efforts have also been made by the government to introduce suitable apparatuses for burning the dead, but the Hindoos still cling tenaciously to the primitive custom of their forefathers, and the furnaces are used only by the more intelligent Brahmins. In Japan the practice of cremation was common from the earliest times, and prevails yet to-day, although not universally, "There is a crematorium in Kioto; generally, however, the corpses are cremated on wooden fagots. The ingenious Japanese contrive to concentrate the heat, and save the fuel at the same time, by covering the dead with a straw mat which has been previously thoroughly moistened with salt water."—*Mahan*.

Among the Karens like the Chinese, everything connected with death is regarded with absolute hatred, all the books, clothing, etc., of the dead, being burned. The body, even the face, is wrapped in a coarse white cloth, and the corpse laid out on a bench in an outer room; rice, fruit, tobacco and betel nut are placed at the head and feet, together with a drinking-cup, mug and spoon, in a basket, and the deceased spirit is invited to come and partake freely, while the nearest relatives surround the body with wails and lamentations for thirty-six hours before cremation.

At the burning the body is separated from the fuel by a sort of kiln designed to keep the ashes of the body separate from that of the wood. Before this is completed, the friends reserve some small bone, usually that of a finger, for subsequent funeral ceremonies held four days later, at which time the bone and the urn containing the ashes are finally laid away in separate graves; the former always being kept a profound secret (*Fendge*).

GREEKS AND ROMANS.

Among the Greeks burning was the almost universal custom. The body after death was anointed, crowned with flowers, handsomely dressed, usually in white, and laid in state with an obolus in its mouth for Charon and a honey cake for Cerberus.

These offices for the dead were usually performed by the female relatives, after which the other kinsfolks gathered around the bed and for three days lamented. On the third day the body was carried out in a coffin, usually of earthenware, before sunrise, the men walking before it, the women and the hired mourners behind. The body was burned and buried outside of the town. Homer's narration of the burning of Pa-

troelus gives so accurate a description of the method then in use, that it is quoted entire in Bryant's translation. The passage referred to occurs in the twenty-third book of the "Iliad" and is as follows:

"They who had the dead in charge
Remained, and heaped the wood and built a pyre
A hundred feet each way from side to side.
With sorrowful hearts they raised and laid the corpse
Upon the summit. Then they flayed and dressed
Before it many fatlings of the flock.
And oxen with curved feet and crooked horns.
From these magnanimous ACHILLES took
The fat, and covered with it carefully
The dead from head to foot. Beside the bier
And leaning toward it, jars of honey and oil
He placed, and flung, with many a deep-drawn sigh,
Twelve high-necked steeds upon the pile.

Nine hounds
There were, which from the tables of the prince
Were daily fed: of these Achilles struck
The heads from two, and laid them on the wood,
And after these, and last, twelve gallant sons
Of the brave Trojans, butchered by the sword;
For he was bent on evil. To the pile
He put the iron violence of fire,
And, wailing, called by name the friend he loved.

They quenched with dark red wine
The pyre, where'er the flames had spread, and where
Lay the deep ashes; then, with many tears,
Gathered the white bones of their gentle friend,
And laid them in a golden vase, wrapped round
With caul, a double fold. Within the tents
They placed them softly, wrapped in delicate lawn;
Then drew a circle for the sepulchre,
And, laying its foundations to enclose
The pyre, they heaped the earth, and, having reared
A mound, withdrew."

Funeral sacrifices were offered on the third, ninth, and thirtieth days after the first ceremonies. On the thirtieth day the mourning ended and the relatives reappeared in public again. It was customary, as with us, to visit the tombs of the dead from time to time and to ornament them with garlands.

ROMAN AND MODERN CREMATION.

From Greece, by way of Latium, cremation reached Rome, where it was practiced from the time of the republic down to the fourth century.

The process at Rome was substantially the same as that made use of at Athens—the pyre being resorted to in either case. At the time of death the nearest relative of an expiring Roman kissed him to receive his last breath, after which his eyes were closed and all present called upon him to restore him if possible to consciousness. The body was then washed in hot water and the undertaker sent for. The corpse was dressed in white and laid in state in the hall with feet toward the door. Branches of pine or cypress were hung at the door, like crape in time of mourning at present.

The body was attended to by hired undertakers (*pollinctores*) whose duties were to wash and clothe it in its richest or official robes, if its owner had possessed such, and if a crown had been received during life this was also added. The body then laid in state for eight days, for it was the custom of the Romans to allow putrefaction to actually begin before resorting to cremation, lest premature burial might take place and for the same reason during these days of watching they frequently called upon the dead by name with a loud voice. At first the funeral always took place at night, but as funeral processions became more elaborate they were held by day, and only those who wished to save expense were buried at night.

On the eighth day the funeral took place, the body being carried in a stone coffin, or wrapped in a purple pall on a golden bier, attended with music and lamentation by hired mourners. Wax, ancestral images formed part of the procession and sometimes there were also representations of the life of the deceased by professional players. Usually there were also funeral services at some one of the temples and in the case of noted personages funeral orations pronounced by a friend from the public rostra, after which the relatives gathered at the funeral pyre. This by law must be constructed of unhewn logs, usually of some resinous wood as cypress, pine or yew, and to assist combustion costly perfumes and oils were poured lavishly upon the body. Plutarch, for instance, tells us that at the funeral of Sylla, so great a quantity of spices were brought by the women that it required two thousand baskets to contain them, and that they constructed of costly incense and cinnamon a statue of the deceased of magnificent size.

All things having been properly arranged and the friends having again thrice called upon the dead, the nearest relative applied the torch to the pyre.

After the burning was completed, the embers were quenched with wine or milk, wrapped in fine linen, and deposited in cinerary urns which were carefully cherished at home, or in the public columbaria. At Rome these funeral urns were placed upright, while in Greece they lay horizontally on the ground and were covered with rugs. In Greece

the ashes were preserved in beautiful mortuary chambers in the houses or in public tombs, a custom that also obtained at Rome, where columbaria were maintained at public expense. These columbaria were subterranean chambers which served to hold the ashes of the deceased, the urns being deposited in niches, hewn out in the rock for that purpose. The rare beauty of those which may yet be seen in the eternal city, led to Hawthorne's famous remark that "he would not object to being decently pigeon-holed in a Roman tomb."

The last funeral fires in Rome expired late in the fourth century, but in countries situated further north the custom of cremation was not abolished before 1300 A.D. In fact at one time cremation was almost universally practiced from the tropics to the extreme north. The Scandinavian nations, by the direct command of Odin upon his dying bed, incinerated, as did also the Saxons and Frisians. The Danish antiquarians describe an age of cremation which they think followed immediately their mound age and lasted until the ninth century. In Iceland there is still extant a proverb to the effect that no woman may be praised until after she is burned, and the Goths and Thuringians burned their dead until the seventh century. Pre-Christian German literature is full of allusions to cremation.

The funeral pyre however, was so strongly discountenanced by the Christian church that as it became dominant, cremation became obsolete. The first modern plea for cremation is Sir Thomas Browne's *Hydriotaphia*, written more than 200 years ago (1658). From that time until 1873 incineration was advocated by but few individuals, mostly physicians. But the cremation which they had in view was that on the pyre, a method a little less barbaric than interment. Hence, the agitation carried on so energetically had few practical results. Notable among these were the incineration of the poet Shelley, and his friend Williams, who were burned, by Lord Byron, Trelawny, and Leigh Hunt.

In 1873, however, Professor Brunetti, of Padua, Italy, made experiments which led to the construction of the first crematory furnace, and thus scientific cremation was inaugurated. The results of Brunetti's experiments were exhibited at the Vienna Exposition, where they attracted great attention. From there the burning of the dead in a scientific way spread and continues to propagate even in South America, Australia, and South Africa.

When cremation was first advocated in this country in 1874, it met with a storm of ridicule and opposition. A Persian gentleman, then residing in New York City, wishing to burn the remains of his wife, was subjected to abuse and even personal violence from the hands of an ignorant mob, until at last he was obliged to bury her to save his

own life. A few years has changed, very greatly, public opinion on this subject, and this change has been largely brought about through the influence of Dr. Julius LeMoyne and Dr. J. M. Keller. The first furnace ever built for cremating the dead in the United States was erected by the former at Washington, Pa., while the persistent efforts of the latter has at last (May 6, 1886) obtained an expression of opinion in favor of cremation, in populous cities, from the American Medical Association.

Incineration can now be performed by means of either gas, hot air, or the direct application of fire to the body, preferably the first method, which is carried on most satisfactorily by the use of natural gas in Pittsburgh and elsewhere. The retort must first be brought to a white heat, which, with natural gas, requires about ten hours. It is not necessary to divest the body of its clothing, or in any way to disarrange the ordinary arrangements for burial, for the corpse has only to be laid upon a board, one-half an inch thick and the length of the body, and placed upon a roller top table, provided also with castors. The body is then covered with an alum sheet, the doors of the retort opened, and the table pushed to the opening, where the board holding the body is easily propelled into the retort and the doors closed. The gas is turned off while this is being done, and not lighted again until the gases evolved from the body begin to burn from the heat of the white hot retort. This obviates all danger of explosion, and as soon as this danger is past the natural gas is again ignited, and in about an hour and a half the process is completed, and, if desired, the ashes can at once be drawn from the furnace.

In view of these facts, whatever views a funeral director, as an individual, may adopt in regard to the best disposition of the dead, it is his duty, as a servant of the public, to be prepared and willing to serve his patrons in whatever way they desire. He is a very short-sighted business man who allows a cremation, or any other, society, looking towards reform in his profession, to be organized in the community in which he lives, without his convincing his neighbors that he is fully informed in regard to the facts. It is, moreover, his professional duty always to be the one best able to render the community any service that it may desire in the disposal of the dead. At the same time he should keep himself thoroughly posted in regard to all the arguments, pro and con, in the matter, and to this end we add those for *anti-cremation*, by its ablest advocate, Dr. Frank Hamilton, who says:

* 1. The danger to health and life from the present mode of burial when the inhumation has been properly made, has, by the advocates of cremation, been greatly overestimated, if, indeed, it can be said to exist at all.

2. Cremation removes effectually one of the most important means of detecting certain crimes.

3. The general sentiment of the community in which we live is opposed to cremation.

Hence, it would be unnecessary, unwise, and unjust to impose cremation by legal enactments."—*Am. Lancet*, Vol. x, Page 189.

"Other objections have been raised to the reform. Leaving aside the religious one, which is pronounced invalid by such men as Archdeacon Farrar, Heber Newton, and the Bishop of Manchester, we will take them up one by one, briefly.

It is urged that the exhalations of cremation are unwholesome. But then, there are no dangerous exhalations. The enemies of incineration should remember that the gases from the corpse must repeatedly pass through an intense heat and improved smoke consumer before they are liberated. Thirty of the gases escaping from the Lancaster crematory were recently analyzed by a chemist and found to be perfectly harmless. In the gas furnaces absolutely no smoke nor odor escapes from the stacks during the process.

It is further claimed that the burning of the dead would destroy the evidence of poisoning. Every crematorium now in existence requires the certificates of two reputable physicians to the effect that the person about to be cremated died in a natural way, and when such testimony is not forthcoming, insists upon a careful autopsy.

And finally the anti-cremationists assert that the universal practice of incineration would rob the earth of its ammonia, and would in the course of time, cause an ammonia famine. This favorite theory of Dr. Mohr, of Bonn, Germany, was refuted by the professor of chemistry at the University of Leyden, Holland: Thirteen of the most prominent chemists of Europe concurred in the opinion given by him. Dr. Mohr has evidently forgotten that ammonia can be manufactured artificially, and that nature derives a far greater supply of ammonia from decaying animals and vegetable than it ever will from humanity."—*Erickson*.

And yet, satisfactory as is the theory and as are the results of modern cremation, civilization does not as yet take to it kindly. Call it prejudice, if you please, but the fact remains that the majority of English-speaking people heartily agree with Dr. Richardson when he says:

"I believe there is no mode of disposal of the dead that is so tranquilizing and solacing at the moment to the living—as inhumation and embalming—and I am far more prepared to see the advancement of this mode * * * * * than of that by sharp, decisive fire."

[4.] INHUMATION.

According to Sir Chas. Lyell, in the most ancient times holes and caves were the first receptacles of human remains. A natural cavity in the ground, or a cave, was probably the first tomb, and very likely in such a one the body of Cain was laid, for the Scripture record speaks of his "blood crying from the ground." But whether Cain was buried or not, inhumation was the general practice of

The Jews.—Abraham, after the death of Sara, spake unto the sons of Heth * * * "give me a possession of a burying place with you that I may bury my dead out of my sight." He thereupon purchased the cave of Machpelah for money, "for a possession of a burying place" (Gen: XXIV, 10) where we find that five others, one of whom was Abraham himself, were subsequently buried.

Jacob's remains were transported from Egypt by his son Joseph with great pomp, and laid in Canaan, according to his desire made known before his death. Moses was buried in the valley of Moab; Miriam, his sister, in the desert of Zin; Aaron in Mount Hor; Eleazer, his son, and Joshua, on the mountains of Ephraim. The bones of Joseph, who is the only one mentioned in Scripture as having been put in a coffin and by the children of Israel brought up out of Egypt, were buried in Shechem in a parcel of ground which Jacob had bought, three hundred years before, of the sons of Hamar, and where he erected an altar to Jehovah.

After the Israelites came into the quiet possession of the promised land and were brought under the requirements of their ceremonial laws, their habits in regard to the dead and their methods of sepulture were somewhat changed. According to the precepts of their law, the touch of a corpse rendered them unclean; for it was a maxim, not only with the Jews but with all the nations of the world, that holy places are polluted with the presence of dead carcasses, or of dead men's bones. When King Josiah desired to profane the altars dedicated to idols, he burned dead men's bones upon them, taking them from sepulchres near by.

The Jews buried their dead in various places. Their law made no provision for the mode, or place of interment. Sepulchres were in the towns and country, by the highways, in gardens and on mountains. Those belonging to the kings of Judah were in Jerusalem, and in the kings' gardens. Saul and his sons were burned, and in time of great plagues, bodies were cremated in the Vale of Tophet, for hygienic reasons.

Ezekiel intimates that the mountain upon which the temple stood was polluted with the dead bodies of their kings. "The sepulchre which Joseph of Arimathea provided for himself was in his garden; that of Rachel was adjacent to the highway from Jerusalem to Bethlehem; that of the Maccabees was at Modin; the kings of Israel were buried in

Samaria; Samuel, in his own house; Moses, Aaron, Eleazer and Joshua in the mountains; and Deborah (Rebecca's nurse), under the shade of trees." — *Wickes*.

The Hebrews who were very careful in the burial of their dead, also resorted to embalming; for in Chronicles we learn of the death and burial of Asa (914 B. C.) "And they buried him in his own sepulchre, which he had made for himself in the City of David, and laid him in a bed which was filled with sweet odors; and divers kinds of spices prepared by the apothecaries' art." In the New Testament we find that Joseph, by permission of Pilate, came and took the body of Jesus, and then came also Nicodemus, which at the first came to Jesus by night, and brought a mixture of myrrh and aloes about a hundred weight. "Then they took the body of Jesus, wound it in linen clothes and with spices as is the manner of the Jews at the present time." It was considered to be a great calamity to be deprived of burial and the Jews denied it not even to their enemies.

The Jewish method of preparation for burial was simply to wash, shave and close the eyes and mouth of the deceased; then to anoint with costly, perfumes and place the body in a coffin, or wrap in a winding sheet, as was done with Lazarus, with spices and aromatics in great profusion to hide the odors of putrefaction. At times they also filled the cavities of the body with myrrh aloes and frankincense and even with bitumin brought from the Dead Sea.

The Chinese.—Of the primitive methods of the Chinese we have not as reliable information as of the Jews, but from the fact that they are the least changeable of all nations, it may be inferred that their present methods are not unlike those of former times. In modern China the body is coffined soon after death, a fan is placed in the hand and a piece of money in the mouth. A filial effort to preserve the body is part of their fashionable orthodoxy: accordingly they fasten up their dead in hermetically sealed coffins, which they make with tight joints and partly fill with lime, so that the corpse is sometimes kept in the house for years, or until the family is able to purchase a tomb, for a Chinaman will sell himself to years of hard labor to obtain the means to bury his parents, or to have his own body transported to his native soil after death, and each family strives to have its own burial place. In times of mourning, the Chinese hang long, white strips of cloth at the door as we do crape, and all who come to the funeral are attired in white, or with white patches tacked on their clothing, for white instead of black is their mourning color. With them the entire burial suit is often made years before death, and is of the same fashion as worn in life, for the Chinese use no shrouds and their coffins are often kept in their houses waiting for twenty years. A coffin is considered a very appropriate present from

a dutiful son to a parent on any festal occasion, so that two or three are often seen at once in their houses. As soon as the body can be robed for burial, it is laid in the coffin and the lid fastened down at once, though, as with us, a large glass plate in the front allows a sight of the body and a silver plate gives name and age. The funeral procession is gaudy with paper images, flags and tinsel paper, and is characterized by all the execrable din and noise of a Chinese band after which come the coffin, food, priests, relatives and hired mourners. At the grave incense and paper clothes are burned, and their ashes, rice, food, flowers and lime thrown into the hole prepared for the coffin. After prayers and scrambling for cash, the grave is closed and with wailing and one loud, final lamentation the guests adjourn to the feast which is always the conclusion of a Chinese funeral; though once a year ever thereafter they visit the graves of their relatives with offerings of food, incense, gilt paper, and paper clothes, and fly kites over their graves.

The Greeks generally employed cremation but it was not universal, for one of the laws of Athens was to the effect that the one who discovered a corpse was obliged to see that it was buried, and he who refused this was deemed impious—for if the body was left uninterred the spirit must wander a full century before it could enter the other world.

The Romans for several centuries buried their dead and to the latest days some of the ancient families, as the Cornelian, adhered to this practice. Burning became the general custom among the Romans during the republic and was almost universal under the empire until in the last two centuries of our era, under the Antonines, interments were again definitely substituted for cremation. The Romans had both private tombs and also puteoli, deep excavations, which were kept for public burial. Slaves were buried in pits at Rome to save expense. Criminals and those killed by lightning were refused burial, and also those dying from infanticide. Children were buried by torchlight at night.

The coffins of the Romans were frequently made of a peculiar kind of stone brought from Assos, which was said to have the power to destroy all of the body except the teeth in a few weeks, hence its Greek name—sarcophagus or flesh-destroying—a name frequently used for all varieties of stone chests designed to contain dead bodies, although coffins in the modern sense of the word were known in Greece. They were most frequently made of baked clay like those used at present in Japan. They also had coffins of brick covered with tiles and leaden and glass coffins.

Both inhumation and cremation were *Druidical* and *ancient British* fashions, and barrows were the oldest tombs. Rough stone coffins or kestraen were also employed, not unlike those found in the so-called pigmy graves of Tennessee, which were once considered the burial places of a

diminutive race, but are now known as ossuaries or stone cists for children's bones.

The Romans in England buried their dead beside their military roads and many Roman stone coffins have been found there. The earliest known instance of a wooden coffin is Arthur's, though wooden boxes hollowed out of the trunk of a tree are found in the English barrows. To these succeed stone coffins for persons only of the higher classes in Saxon times and throughout the middle ages, and these were not quite obsolete in the reign of Henry VIII. (1509). Leaden coffins were also occasionally used. For a century after the Conquest the usual substitute for a coffin was to wrap the body in the strongest bull's hide, which in case of the nobility was gilded. In this fashion were buried Henry I., the Empress Maude, King John and James III. of Scotland. In the time of Edward II. and III. even persons of distinction preferred to have their bodies committed to the bare earth, and it was the common custom in the time of Queen Elizabeth to bury only in winding sheets.

The *Early Christian's* burial was exceedingly simple and suggestive. No hired mourners or attendants were allowed, their fellow Christians attending to all of the wants of the dead without hire. After the body was properly washed and arrayed it was laid in some church or place of meeting where prayers and psalm-singing were continuously held, until the time of the funeral. Burial took place during the day to signify that Christian death was a victory, and the funeral a triumphal procession with branches not of cypress, but of palm with olive and evergreen leaves on the coffin. The corpse was laid in the grave with the face upwards and the feet to the east in token of the resurrection, except where it was the custom to bury their pastors with their faces to the east that they might meet their people on the morning of the resurrection, for it was the general expectation that the coming Christ would appear in the East.

The *Mahometans* bury their dead uncoffined, usually on the day of death, in order that they may the sooner reach Paradise. The prophet forbade wailing, but the prohibition is usually disregarded, for hired mourners are generally employed, sometimes at home, sometimes attending the body on its way to the grave. Selections from the Koran are recited at the house by the proper religious functionary, after which the funeral procession is arranged, the male relatives preceding the bier and in front of them six or eight blind men chanting a profession of faith, accompanied by the same number of school boys reciting religious poems descriptive of the last judgment. Behind the bier come the female relatives and hired mourning women with tambourines, crying, weeping, and shrieking forth the praises of the deceased. If the dead man was rich, camels follow bearing bread to distribute to the poor at

the tomb, together with a buffalo to be slaughtered for the same purpose. When the bier reaches the mosque it is laid in the place of prayer with its right side toward Mecca, and the priest standing at the other side recites the virtues of the deceased. The body is then laid in the tomb, with the face towards Mecca and the services are concluded.

The *North American Indians* practiced inhumation as the most frequent method of burial; its simplest mode, according to Dr. Yarrow, was to make a large round hole in which the body was placed, either upright or on its haunches. The Carolina tribes first made a sort of vault in which the body was placed in a cane coffin on layers of bark; the Saes and Foxes were also careful to prevent the earth coming in contact with the corpse. The Creeks buried in a round hole, about four feet deep, directly under the abode of the deceased, while the Comanches wrapped the body in a blanket, tied with cords into a round, compact bundle and tumbled it into one of the cañons with which their country abounds. The Pueblos roll the corpse up in a buffalo robe, tie it tightly with a lasso and bury it in a grave seven feet deep. Indian burial grounds are very widely distributed over our country, immense mounds being found in Ohio, Illinois, Tennessee and Kentucky, and their varied contents carefully studied by the archeologists, have told us what little we know about the prehistoric Mound Builders.

At the time of the settlement of America, according to Sir Henry Spelman, uncoffined interments were the rule amongst the humbler classes. In England "some decent coverings were deemed necessary but this was all," so that it is more than probable that many of the pilgrim fathers were thus-interred.

As early as 1703, however, we find record of coffins provided for the poor: and Roger Williams was certainly buried in a coffin as early as 1683 (Wickes, page 143), so that for the past 200 years inhumation in coffins may be said to have been the custom of this country. In the memory of the writer these coffins were all made by hand by the undertaker, who attempted little more than this for the care of the dead. The labor-saving machinery of the last quarter of a century has transformed the undertaker from a carpenter to a funeral director, for his chief duty is no longer to painfully steam long boards into the sides of a coffin, but to intelligently and scientifically care for the dead. By his skill decomposition can now be held in check at will, for with the means at present at his command he may choose the antiseptics best suited to his particular purpose; for, clearly understanding what putrefaction really is, he has now-a-days learned how to successfully combat it. The exigencies of the late war forced him to solve this problem and the result to-day is that the American undertaker has become a better than the ancient Egyptian embalmer.

How this has been accomplished will be described in detail in a subsequent section. This ought, however, to be prefaced by an historical account of the growth of embalmment elsewhere.

[5.] EMBALMING.

The art of embalming, or the preservation of the dead by means of balsams and other antiseptic substances, was first generally adopted by the Egyptians. History is silent as to whether it originated among themselves, by accident or design, or whether they learned it from other and older nations. It certainly was practiced at a very early date, the mummy of King Pepi being estimated to have been embalmed 3600 to 3800 B.C. and that of King Menkara in the British Museum is approximately assigned to 4000 B.C.

Embalming among the Egyptians was not a matter of choice. By their religious law it was compulsory, being performed not only for every native Egyptian, but also for all strangers dying in the land, as was done for Jacob and Joseph (Gen., L. 2) as well as for slaves, captives and criminals, lepers and certain of the lower animals. Various writers have given to us what seemed to them to be its most probable origin. Thus Cassius affirms that the method was invented on account of the inability of the Egyptians to bury their dead during the period of inundation. Volney and Pariset believe the custom was due to the frequency of the plague. Herodotus avers that it was performed for the purpose of preserving bodies from the ravages of wild beasts. Other writers have also given us various reasons why the Egyptians embalmed their dead, but the most plausible reason and the one which is now generally believed to be the true one, is that it arose from the religious belief of the Egyptians that after two thousand years the soul would return to seek the body again which it would reoccupy in its original form, if it could find it preserved incorrupt, hence to refuse embalmment in Egypt was as grievous a lack of piety as to leave a body unburied among the Romans. The number of mummies still remaining in Egypt is almost incredible. According to Belzoni there are eight to ten millions of mummied bodies in Thebes alone. The whole mountain side on the west bank of the river is one vast necropolis. The open doors of tombs are seen in long ranges and at different elevations, and on the plain pits have been opened in which have been found a thousand mummies at a time. It has been estimated that 400,000,000 human mummies were made in Egypt from the beginning of the art of embalming until its discontinuance in the sixth century. Doubtless the warm, dry atmosphere of the country has had as much to do with the preservation of these bodies as the art of their embalmers, for an Egyptian mummy brought to a changeable climate like our own begins to disintegrate as surely as Cleopatra's Pillar

in New York Central Park. So evident is this that many assert all mummies may have been formed by natural causes only, e. g. Penicher, Clauderus, De Maillett, Rouelle and Gamal cite examples of this nature: "A whole caravan, or some travelers, disappear under a mass of sand; years, centuries pass by, then a new revolution in the disposition of these masses restores to the light of day these bodies which a previous revolution had engulfed, blackened, dried, and lightened by the loss of all their fluids and converted into mummies."

Humboldt met with true mummies in Mexico, where he saw with astonishment that the old battle fields of the time of the conquest by the Spaniards were covered with the dead bodies of both Spaniards and Peruvians dried and preserved to that time. And today persons dying while crossing the Arabian desert, when for the lack of time and other causes their bodies are permitted to remain exposed to the elements, are afterward found in a perfect state of preservation, simply mummified as was, according to Herodotus, the army of Cambyzes after his disastrous expedition to Egypt.

NATURAL MUMMIES

are formed by the general qualities of the air and earth; others by purely local influences. In the first series we include the mummy of the sand and those of avalanches; in the second, those discovered here and there in certain sepulchres, as in the Convent of the Capuchins, near Palermo, and at Rome, in the caves of St. Michael at Bordeaux, in the cemetery of the Church of Saint Nicholas, the cloister of the Carmens, the caves of the Jacobins and the Cordeliers at Toulouse, at Strasburg, etc. The famous mummy of St. Carlo Boromeo, in the vault of the splendid Cathedral at Milan, is another remarkable instance. The body is as black and solid as an Egyptian mummy. It was removed from a cemetery in the vicinity after having remained there many years. No artificial means had been resorted to for its preservation. In the Church of St. Thomas, at Strasburg, are the mummified bodies of the Count of Nassau and his daughter. These relics, six hundred years old, are habited in the costume of that epoch. The coat, small clothes, etc., of the father have been replaced by exact imitations, but the garments of the daughter are actually those in which she was buried, consisting of a blue silk gown, richly ornamented with lace, with diamond rings on her fingers, and jewels on her breast. The body is well preserved, with the exception of the face. Bunches of silvered flowers still adorn the top of the head, arms and shoulders. The features of the Count are almost perfect. Similar bodies may be found in the vault of the Kreuzberg church, located near Bonn on the Rhine. Here may be found some two dozen of mummified monks, some of them centuries old. They were all

habited in the costume of the period, and appear to have died at an advanced age. These are natural mummies, or the result of simple dessication, the skin resembling leather. It is probable that we may refer to similar causes, those interesting subjects discovered some years ago in the caves of St. Michael at Bordeaux, upon which Dr. Boucherie, fifty years ago, made an elaborate report, from which we quote :

“The bodies exposed to view at Bordeaux, in the cavern situated beneath the tower at St. Michael, were deposited there in 1793, nearly in the same state in which they appear at present. They came from the sepulchres of the church and the adjoining cemetery. A great number of bones, and the wreck of soft parts, dried and preserved like the whole bodies, form a layer of seventeen or eighteen feet, upon which are supported the inferior extremities of seventy objects arranged in a circle around the wall and retained in a vertical position by the cords which bind them. Some of these, they say, had remained in the earth many centuries, others from sixty to eighty years or more. * * *

“The skin of all these mummies, of a more or less gray color, dried and rather soft to the touch, gives the sensation of parchment slightly stretched upon the organs, dried, and of the consistence of amadou, or spunk. The articulations are stiff and inflexible. The chest, the abdomen and the cranium, examined carefully, did not show any incision or any regular opening indicative of any trace of embalming, even the most imperfect. The different features of the face, still distinct among some of them, displayed a variety of physiognomy. Two or three of them displayed the hair of the beard very well preserved. The teeth were healthy and covered with brilliant enamel. The upper and lower extremities are entirely dried and whole in many of the subjects, and are provided with the phalanges; the last, however, divested of its nail. * * * The skin raised and viewed on its interior surface is tanned like the exterior. All traces of cellular tissue has disappeared. The muscles, separated from the skin, have the color and consistence and almost the internal structure of dried pith. On introducing the hand into the chest, some rudiment of lung was found, a net-work very similar to that of leaves deprived of their fleshy part. They might be taken for a mass of leaves dissected by the caterpillars, and rendered adherent by the threads and viscous fluid that these insects deposit. The intestines, also dried, are nearly in the same state.”

The same phenomena still occur in different parts of the world, under a moderate temperature: thus, about 1660 M. de La Visee and his domestic, having been assassinated at Paris and interred on the place where the crime was committed, their bodies were discovered after the lapse of a year, whole and readily recognizable; a cloak, even, lined with plush, had not suffered the least alteration.

The mummy of the avalanches, and all those, the preservation of which is due to a constant low temperature, retains the freshness and plumpness of the tissues for years and for centuries, if the conditions of the medium remain the same; but, under these circumstances the action of cold exerts no other influence than the suspension of decomposition, for the moment it ceases the tissues are rapidly exposed to the laws of inorganic chemistry.

In those cases, moreover, where the bodies exposed to cold are subjected to a dry and lively wind, a real mummification may occur, as takes place upon the Great St. Bernard:

“There is upon the summit of the Great St. Bernard a sort of morgue (dead house) in which have been deposited, from time immemorial, the bodies of those unfortunate persons who have perished upon this mountain. The hospice is the most elevated habitation in Europe, being 7,200 feet above the level of the sea. The temperature is always very low, rarely above zero, even during summer. This extensive establishment is built upon the borders of a little lake, at the bottom of a gorge; the principal mass of the building represents a long parallelogram placed in the direction of the gorge, so that its two principal faces, pierced with numerous windows, are sheltered from the wind by the rocks, whilst the two extremities, on the contrary, are exposed to all the violence of those which blow from one side of the gorge to the other. About fifty feet beyond this principal building, and a little out of a right line with it, is situated the *morgue*, a sort of square chamber, the walls of which, three or four feet thick, are constructed of good stone, and the arched roof of which is very solid. Two windows of about four feet square are pierced in the direction of the breadth of the valley, directly facing each other, so that a perpetual current of cool air traverses the interior of the chamber. There is, further, but a single table in this morgue, upon which they place the bodies when first introduced; after awhile they are arranged around the walls in an upright attitude. There were several of these mummified bodies along the walls of the chamber, but a greater number were entirely divested of flesh, and lie scattered about the earthy floor of the room. They informed me that decomposition only took place when the bodies fell by accident to the ground, which was owing to the humidity occasioned by the snow which occasionally entered with the currents of air through the windows of the morgue.”—*Dr. Lenoir*.

EMBALMING AMONG THE GUANCHES.

The aboriginal inhabitants of the Canary Islands, like the ancient Peruvians, adopted an analogous method of dessication, although with

them warm air instead of cold was the preservative agent utilized. Gannal says of them

“The Guanches and the Egyptians are the only nations among whom embalming has become a national custom, and there exists in the process and mode of preservation of both such striking analogy that the study of the Guanch mummies is, probably, the surest means of arriving at some proper notions of their origin and relationship. To make ourselves understood in the subject which now occupies us, we ought to remark, that the details known of the mode of embalming among the Guanches will enlighten and complete the descriptions that ancient authors have transmitted to us of the Egyptian processes; it is thus that it appears to us without a doubt, that their silence on dessication as a part of the act of mummification, is a simple omission on their part; that this desiccation was continued during the seventy days of preparation; that it constituted the principal part of the processes adopted, and that, because among the Guanches desiccation was placed in the first rank.”

“The Guanches preserved the remains of their relations in a scrupulous manner, and spared no pains to guarantee them from corruption. As a moral duty, each individual prepared for himself the skins of goats in which his remains could be enveloped, and which might serve him for sepulchre. These skins were often divested of their hair, at other times they permitted it to remain, when they placed indifferently the hairy side within or without. The processes to which they resorted to make perfect mummies, which they named *Xaxos*, are nearly lost. Some writers have, nevertheless, left details on this subject, but perhaps they are not more exact than those which Herodotus has transmitted to us upon the embalming of the Egyptians.

With the Guanches, the embalmers were abject beings; men and women filled this employment respectively for their sexes. They were well paid, but their touch was considered contamination; and all who were occupied in preparing the *xaxos* lived retired, solitary and out of sight. There were several kinds of embalming, and several employments for those who had charge of it. When they had need of the services of the embalmers they carried the body to them to be preserved and immediately retired. If the body belonged to persons capable of bearing the expense, it was extended at first on a stone table; an operator then made an opening in the lower part of the belly with a sharpened flint, wrought into the form of a knife and called *tabona*; the intestines were withdrawn, which other operatives afterwards washed and cleaned; they also washed the rest of the body, and particularly the delicate parts, as the eyes, interior of the mouth, the ears and the nails, with fresh water saturated with salt. They filled the large cavities with

aromatic plants; they then exposed the body to the hottest sun, or placed it in stoves, if the sun was not hot enough. During the exposition the body was frequently imbued with an ointment composed of goats' grease, powder of odoriferous plants, pine bark, resin, tar, ponce stone, and other absorbing materials. Peuille thinks that these unctions were also made with a composition of butter, and desiccative and balsamic substances, among which are mentioned the resin of larch, and the leaves of pomegranate, which never possessed the property of preserving bodies.

On the fifteenth day the process should be completely terminated; the mummy should be dry and light; the relatives send for it and establish the most magnificent obsequies in their power. They sew up the body in several folds of the skin, which they had prepared when living, and they bind it with straps retained by running knots. The kings and the *grandees* were besides, placed in a case or coffin of a single piece, and hollowed out of the trunk of a juniper tree, the wood of which was held as incorruptible. They then, finally, carried the *xaxos*, thus sown and encased, to inaccessible grottoes consecrated to this purpose.

Another less expensive mode of preserving the dead, consisted in drying them in the sun, after having introduced into the belly a corrosive liquor; this liquor eats into the interior parts, where the sun does not act sufficiently to prevent their corruption. Like the other *xaxos*, the relatives sowed them in skins and carried them to the grottoes.

These mummies, such as they are found at the present day, are dry and light; many have perfectly preserved their hair and beard, the nails are often wanting; the features of the face are distinct, but shrunken; the abdomen is contracted. In some, there exists no mark of incision, in others are observed the trace of a rather large opening on the flank. The *xaxos* are of a tanned color with generally an agreeable odour: exposed to the air, out of the sacks of goat skin, which are admirably preserved, they fall by degrees into dust: they are punctured in many places; surrounded by the chrysalides of flies, proceeding probably from maggots, deposited upon the body during its preparation: these larvæ and chrysalides, which could not be reproduced, are preserved whole and healthy like the mummies." (M. Bory de St. Vincent on the Fortunate Islands.)

The Chevalier Scory says, that these mummies are two thousand years old, and in appearance are almost precisely like the mummies still found among the Peruvians, who like the Mexicans embalmed their incas or kings. The Ethiopians (Macrobian) according to Herodotus, embalmed and dried their dead, and then, after having rubbed them with gypsum and painted them to resemble life—incased them in a block of some transparent substance (glass?) To the same author we are also mainly indebted for our present knowledge of the process employed by

the *ancient Egyptians* in their various methods of embalming. Its cost depended upon the method adopted, the cheapest costing but little; while the most perfect process required an outlay of about \$1200. This last was a tedious process, consuming in all over two months and was carried on in the following manner:—The brains as far as possible were removed through the nostrils by an iron wire introduced, thence through the ethmoid bone into the cavity of the skull, which was then fully cleaned with antiseptic injections. The intestines were also removed by an incision made in the left side and this was considered so detestable an office that the one who was appointed to it was pursued by stones and curses by the bystanders when he had completed his work. The intestines were removed through this opening and were commonly preserved in a mixture of sand and asphalt and buried in vases placed near the mummy, the abdomen being filled with chips and sawdust of cedar and a small quantity of natron, the native carbonate of soda, found at the natron lakes in the Libyan desert. The cavity of the abdomen was then cleaned with palm wine and filled with myrrh and cassia and after a prayer by the priest that all sins of eating and drinking might be forgiven, the incision was sewed up. After this the body was placed in a bath of native carbonate of soda where it was left for seventy days. Occasionally the viscera were, after antiseptic treatment, either in part or entirely replaced in the body together with amulets. The body was then washed and handed over to an inferior order of priests, whose duty was to envelop it in multitudinous bandages, sometimes as many as 700—1,200 yards of $3\frac{1}{4}$ inch bandages having been unrolled from a single mummy. Each finger, toe, and limb was separately swathed and then the whole body was enveloped, being padded as necessary to preserve its shape, the linen bandages for this purpose often being gathered for an entire lifetime. The under bandages were undoubtedly laid on wet, probably being first dipped in spirits, or palm wine. The outer bandages were of gummed cloth and the body was then ready for the coffin, or sarcophagus. These were often gaudily painted and ornamented with hieroglyphics indicating the previous rank and occupation of the deceased, and to still further identify the mummy its bandages were marked with indelible ink.

There were other and less expensive modes of embalming, especially of the lower animals, in use among the Egyptians, and one of these was by means of injecting the abdomen with cedria, a distillate from the pitch pine, and a subsequent natron bath; while the bodies of the poorest were preserved by immersion for seventy days in this alone, after a previous rinsing of the emptied abdomen with Syrian turpentine. Others were embalmed by plunging the body into molten bitumen, as was generally the case with the very poorest. Occasionally tanning was resorted

to, but these cheaper methods produced very inferior results, as may be seen in the mummies of the poor which are black, heavy, brittle, and so saturated with bitumen that it is claimed they are now used for fuel on some of the modern Egyptian railroads. Curiously but few mummies of children have been found, although it was the Egyptian practice to embalm even those dying at birth.

In the light of recent discoveries the Egyptian method is seen to have been thoroughly scientific, although probably unwittingly so. Little as they knew of the modern theories of putrefaction they chose substances now known to possess antiseptic properties. In fact their preparation of a body was thoroughly antiseptic and Listerian, so carefully was the mummy enveloped in numerous layers of byssus the intermediate spaces filled with gauze impregnated with essential oils and substances containing (carbolic) acid, resins and balsams, and the whole covered with layers of asphalt, or with mackintosh, exactly like a modern Lister dressing.

Under the Greeks and Romans the art of embalming declined, although it was occasionally practiced as late as the sixth century: since which time, until quite recently, it cannot be said to have been in use, not however because it is a lost art, as is sometimes said, for there are still extant more elaborate rituals and hand-books for the preparation of the dead according to the Egyptian fashion than are known in any other language. Four varieties of these are known, the first is devoted to a description of the surgery necessary to properly remove the viscera: the second contains a list of the gums, resins, spices and forms of bandages used; and the third and fourth are rituals proper, or litanies and prayers to be recited over the dead. As late as the time of St. Augustine, according to Gabriel Clauderus, the bodies of Alexander and Ptolemy were still preserved. This he claimed was not in the first case due alone to the honey in which the body was preserved, but to fabulous balsamic properties inherent in Alexander's body, which, according to Quintus Curtius, was "of a composition so rare and wonderful, that his skin, mouth, and all his person, rendered a very agreeable odor, and perfumed his clothes. It is said that his corpse, by the negligence of his friends and of his captain, remained several days without being embalmed, and that, nevertheless, when they went to visit it, it was found sound, without blemish, having even the complexion as fresh and florid as if he had been living, although he died of a continued fever: his appearance was so natural that the Egyptians and Chaldeans, who were charged to embalm him after their own manner, were at first afraid to approach him, thinking he might not be dead."

EMBALMING IN EUROPE.

The art of embalming was never entirely lost in Europe, for DeBills, Clauderus, Ruysch and Schwammerdam boast of great success, and De-

Bills was wonderfully successful, probably the most so of any of the embalmers of his day. His method died with him, except that Clauderus discovered that some saline was undoubtedly the efficient agent in his work, although he tried carefully to conceal the fact by the free use of aromatics.

Clauderus' salt was the next popular preparation and was thus prepared :

"Dissolve one pound of common salt with a pound of oil of vitriol in a crucible, apply a cover closely luted, and distill it gradually in a sand bath; you may pour off a spirit very excellent for a lotion; in the bottom of the crucible will remain a *caput mortuum*, which should be dissolved according to art, and after evaporation, you will have the salt so much esteemed by the author." The *caput mortuum*, or residue thus prepared and left behind in the crucible was nothing more or less than sodium sulphate, (which see) with no more remarkable properties then than now. DeRusych's famous preservative was only dilute alcohol, if he told the truth, for when this eminent Dutch anatomist sold his cabinet to Peter the L., he gave a manuscript in which he made known the composition of his preservative fluid in which he expressly stated that this liquor was nothing more than the spirit of malt to which was added during distillation a handful of white pepper. Ruysch either did not give the true composition, or exaggerated its virtues, for it is far from possessing the effects which have been attributed to it; although it has the value of any strong alcoholic fluid, containing also possibly a small proportion of fousel oil (which see) Schwammerdam's and DeMeetz's methods were essentially alike and relied upon maceration in turpentine; the latter's directions being as follows: "After the corpse has been emptied and cleaned of its excretions, it is placed in a leaden coffin, and there macerated in a sufficient quantity of pure oil of turpentine, and after some days of maceration, wash it with spirits of wine to remove the odor, then sprinkle it with a strong tincture of myrrh and aloes, which they call *balsamum mortuorum*, and that it be finally dried in the sun," and Schwammerdam's directions are these:

"It is necessary, then, to obtain a pewter vessel of sufficient size to contain the body to be embalmed; place at a distance of about two fingers depth of the bottom, a hurdle of wood, pierced with many holes; place the body on this hurdle, and pour on oil of turpentine to the height of three fingers, keep the vessel quiet, tightly, and less and less hermetically covered during a certain space of time; in this manner the oil, of a penetrating nature, will filtrate by degrees into the body on which it is poured, and will expel the aqueous portions, the principal cause of the fermentation which tends to corruption."

This method is as old as the Egyptians, but the odor of the turpen-

tine and its solvent properties upon certain of the tissues have rendered it obsolete in these latter days and the same is now true of the once famous

PENICHER'S BALM,

which at one time enjoyed as high a reputation as some of our modern preservative fluids, but as may be seen by its annexed formula, its composition was as comprehensive as the claims made by himself for its powers. We give his own words: It is compounded by the roots of Angelica, Imperatoria, Galanga, Acorus, Carolina, Caryophyllata, Gentian, Enula Campana, Valerian, Florentine Iris, Flambe, Calamus Aromaticus, Ginger, Pyrethrum, Cyperus, Dictamnus, Rosewood, Sassafras, Guaiacum, Juniper, Box Wood, Citron Bark, Oranges, Canella, Cassia Lignea, Tan, Nutmegs, Mace, Cloves, Cubebs, Spicknard, Colocynth, Bay Berries, Juniper Berries, and Myrtle Berries, Gall Nuts, Cypress, Anise Seed, Cumin Seed, Fennel Seed, Coriander Seed, Cardamom Seed, long, white and black pepper, Rue Leaves, Thyme, Absynth, Savin, Horehound, Mugwort, Laurel, Mint, Myrtle, Calomint, Balmgentle, Majorum, Rosemary, Sage, Summer Savory, Wild Thyme, Pennyroyal, Mountain Mint, Hyssop, Nepeta, Basilic, Scordium, Flowers of Saffron, Roses, pale and red, Stachas, Centaury, Melilot, Chamomile, Germander Chamsepitys, Hypericum, Caraway Seed, Dill Seed, Lavender * * * and is calculated either by the aromatic virtues of sulphur and volatile salts, medicaments which enter into its composition, or by a strong bitter principle which consists in a very penetrating particle, the property of which is to consume and attenuate the crude matters, which disposes and hastens the body to corruption; or by remedies inheriting a quantity of particles which dissipate and absorb all putrescent moisture, or by their viscosity agglutinating the parts which ferment and rarefy too readily; or, finally, by their astringency, which, fixing the same parts, prevents the resolution of all."

The late Stephen Pearl Andrews could hardly have written a more unintelligible panegyric, or one that could have given us less information as to the action of this polypharmacy, whose value, if any, depended on the essential oils and tannin contained in its multitudinous constituents. Penicher's method, however, received royal favor and he gives in detail the process he employed for the preservation of princes: "First make a long incision from the superior part of the sternum, to facilitate the examination of the contents of the chest, and to investigate the cause of disease and death, in order that a faithful written report may be made in concert with the physicians and surgeons of the king. All the parts contained in this cavity must be removed; he will afterward descend to the lower belly and examine all their contents, which he will remove for that purpose, taking away everything disposed to corruption.

"The surgeon, having emptied these cavities, ought to work at the

head, of which he will saw the cranium in the same manner as for anatomical demonstrations; and after he shall have examined and taken out the brains, the apothecary must carefully wash the cavity with aromatic wine and alcohol, and then fill it with the powdered balm he will have prepared, and with cotton and tow soaked in some fluid balsam, in such a manner that there will be several layers of these stoupes and powder applied one above the other; after which replace the bones of the cranium and sew up the skin. He will then rub the head all over with the liquid balm, and bathe the face frequently with the same; envelop the head in a deep cap, which must be waxed; and after having insinuated into the nose, the mouth, the orbits of the eyes and into the ears, cotton, soaked in liquid balm, the oil of nutmeg and cloves, he will labor at the abdomen which must be washed in the same aromatic wine and alcohol, and rubbed with some of the aforesaid balms, and, finally, stuffed abundantly with powder and tow, until all these matters, distributed one above the other, will form the natural size and appearance of the abdomen, which must be sewn up. The surgeon will take care that sections be made in the veins and arteries, in order to divest them of blood and humidity, which will be observed regarding the arms, thighs, legs, heels, and other parts, as the back, shoulders, and buttocks, turning the corpse for this purpose, face towards the table; in these thick and fleshy places, the incisions must be long, deep, and numerous, penetrating even to the bone; and when the large vessels have been opened and purged of their blood, the pharmacien will fill all these spaces with the powder, and then sew them up with a needle and thread, after having sprinkled and bathed them, in aromatic wine and alcohol; for it is necessary to take care and foment incessantly these parts; absorb from them, if possible, all humidity, and dry them with a sponge, previous to rubbing them with liquid balm, or one of the liniments, and fill them with the stoupes and said powders. Finally the whole must be sewed up very neatly, so that the body may not be disfigured; for the same reason the face ought not to be incised, and we ought to endeavor so to preserve the features that they may be easily recognized, as I have recently witnessed on the opening of a coffin of a bishop, who was embalmed more than fifty years ago and whose countenance was not in the least disfigured. For this reason the artist will make use of fine powders, of aloes, myrrh, and others; as regards the body, he will rub and anoint it with the liniment which he will have prepared, adding thereto the powder which he will make into a paste. And it is necessary to remark that in proportion as he finishes the embalming of each part, the surgeon ought to bandage it with bandages of linen soaked in the liniment, so that they will resemble a species of corset, and in form of a letter X; let them make several convolutions one upon the other, to keep the parts of the

body compact, and prevent the aromatics escaping from the cavities filled with them; these bandages should commence with the neck and finish with the feet and hands; they must be long and broad for the body, thighs, legs, and arms, but narrow and short for the fingers. This done, put on the chemise; ornament the subject with the exterior marks of dignity which were possessed during life time, and wrap it in a linen cloth soaked in liniment, which will serve as an adhesive plaster: which must be tied by the two extremities with a riband; above which, envelop it with the cere-cloth, which should be very closely bound with a cord. Finally, deposit the body in a coffin, the intervals of which must be filled with what remains of the powder, if there be any, or with parcels with dried aromatic herbs; close it and solder it with the utmost exactitude. Place on the outside a plate of copper, or some other durable metal, upon which has been engraved some appropriate inscription, to serve as a memento to posterity. The coffin must be placed in another of wood, which may be covered, if desirable, with a mortuary cloth."

"This work being accomplished, we next come to the heart, which, as I have already stated, is separately embalmed. Supposing, then, it has been removed from its place, divested of its pericardium, and both its ventricles, opened, frequently washed with spirits of wine, and well cleaned of clotted blood, and of all other impurities that may be attached to it, and having allowed it to soak during the preceding operations in spirits of wine, or in distilled oil of turpentine, the apothecary now takes this viscera thus prepared: he fills the ventricles with powdered aloes, myrrh, benzoin and styrax: he may even rub it with oil, or essence of nutmeg, cloves and camella, as also with the tinctures of ambergris, musk and civet; he will then arrange it in perfumed cotton, so as to make it contain the powders, which, with the oils, will form a paste, and he will place it in a little sack of cere-cloth, perfumed with some of the above named essences, with which also he will rub the box in which it is to be inclosed, both internally and externally, solder it carefully, and envelop it in taffeta of a certain color, which must be equally soaked and rubbed with essences or tinctures, and tied with ribands of the same color.

"The body and heart being thus embalmed, it only remains to speak of the viscera, the lungs and the brain.

"In order more easily to clean the viscera, they must be opened lengthwise, incisions must be made in the lungs, the spleen, the uterus, and the other contents of the cavities; cleaned of blood, serosity, and other foreign matter, which would cause them to putrefy in a little time: then washed with strong spirits of wine, having been previously washed in other liquors, and then arranged in a barrel, so that the powder first covers the bottom, placing a portion of the viscera on this first layer, and

afterwards a second bed of powder; and continue thus to place the viscera and the powders alternately, and by layers, until the barrel be nearly full, taking care that the last layer consists of this prepared powder, which must not be spared on this occasion. This barrel, which ought to be made of lead, should be placed in a second of wood, which must be accurately headed and pitched.

“Finally, when the body is to be publicly exposed on the bed where it died, the face should be washed with spirits of wine, and with true balm, refreshing it frequently, and when it is necessary to expose it on a bed of parade to remain several days, it is commonly sufficient to mould it in wax, and to show only its external figure, during the time that the body is upon the bed embalmed in a coffin. But, when the body itself of the deceased is exposed, it is necessary, in the first place, to paint and powder the hair or wig with a fine powder of pleasant odour; shave the beard, if there be any, fill the mouth with powder and cotton, to elevate and protrude the cheeks, to which may be applied a little rouge, as well as to the lips; if the natural eyes have been removed, replace them with artificial eyes, force perfumed cotton up the nostrils; the nose may be refreshed with a linen cloth liberally endued with true balm, during the time that the subject is withdrawn from public view; thus, the mouth, and generally all the parts that ought to be seen, will be in their natural state, to the end that it may be the more readily recognized.”

We have given Penicher's method in full as a description of the best known up to the time of Chaussier's discovery of the preservative properties of corrosive sublimate. Before that all preservation by balms and stoupes was due to the ability of their tannin to harden the skin and of their aromatics make the products of putrefaction less disagreeable.

In 1834 Chaussier injected the arterial system with an alcoholic solution of corrosive sublimate for the preservation of the dead. The process of Chaussier was still a long way removed from modern embalming, but it was an improvement over all others which preceded it in that it substituted an efficient agent for those uncertain in their operation. This process of Chaussier, as modified by Boudet, was as follows:

The viscera of the body and the brain were removed and preserved separately. The cavities left by the removal of these organs was filled with tow or cotton, so compressed as to prevent the sinking of those parts of the body.

While these operations were being performed, the body was plunged several times alternately in a bath of *pure alcohol*, and in one of *alcohol saturated with corrosive sublimate* after incisions inherent to the operation had been closed by proper sutures. The body was laid in a wooden trough and completely immersed in a watery solution of corrosive sublimate. After three months of maceration the body was taken out, sus-

pended horizontally on a network of strong linen bandages in a well-ventilated place, and left to dry until completely desiccated. If necessary, the sides of the body were padded by some new addition of tow in the interior, to avoid any deformation. This process has, among other advantages over the older ones, that of keeping the body free from all external envelopes which might hide it from sight.

But this method is not free from many objectionable points. In the *first* place it requires a large quantity of a substance high in price, and of rather dangerous manipulation; *secondly*, the operation is long, tedious, requiring three months for its proper performance, and lastly, the mutilation of the body strikes the relatives and friends with an unconquerable feeling of disgust and repugnance.

The year following, Grey in England and Gannal in France embalmed the dead by injecting the arteries with solutions of arsenic and alumina salts respectively. With Gannal (1835) modern embalming may be said to begin; for, although Chaussier's discovery and Beclad's, Larrey's and Boudet's practical application in baths and stoupes prepared the way, J. N. Gannal was the first to scientifically employ the modern methods of arterial injection.

Furthermore the time required for his operation was of comparatively brief duration, as a simple injection of the arterial system and a short maceration are substituted for the removal of the viscera and the numerous incisions of all the preceding modes of preservation. Moreover, the tissues by his process preserve their specific color and elasticity, for they suffer no mutilation, but are preserved entire by injecting through one of the carotid arteries a certain amount of aqueous solution of acetate of alumina. The injection is followed for two or three days by a maceration of the whole body in the same liquid.

Gannal's process, somewhat modified, is still employed in France and Italy, after the following manner: The body is first thoroughly cleansed with soap and water and then well saturated with a concentrated solution of alumina salts, the same solution being used to inject the intestines and the circulatory system through the axillary artery, about two gallons being employed for this purpose and in addition tannic acid is freely used in the abdominal cavity.

The agent Gannal used most successfully was the acetate of alumina (which see), and which, curiously enough, after the lapse of fifty years, has been recently proven both a reliable disinfectant and antiseptic.

During the past fifty years so large a number of substances have been suggested and employed that it would hardly be profitable to attempt a chronological enumeration of them here, but we shall endeavor by the assistance of Dr. D. S. Lamb of the U. S. Naval Museum to give a succinct grouping of the more important of these agents, reserving a detailed

description of their properties, advantages, and disadvantages until a later section.

For convenience we adopt the following division, viz:

1. Gaseous.
2. Inorganic Solutions.
3. Organic.

And as nearly as possible we shall follow the order of the MSS. very kindly furnished by Dr. Lamb for the preparation of this part of the work.

1. GASEOUS COMPOUNDS.

Too little attention has been paid heretofore to the antiseptic powers of certain gases. It is a well known fact that some of the gases which are the result of animal and vegetable decomposition are, to a certain extent, the means of their own disinfection, hence, some of these are endowed with deodorizing as well as antiseptic properties. Besides, there are other valuable gaseous antiseptics whose use would be much larger than at present were it possible to handle them more conveniently. Chief among these is

Chlorine, or oxygenated muriatic acid, as it was originally called, was first proposed as a disinfecting agent by Pomeroy in 1871, and later strongly advocated by Cruickshank. Faraday, to disinfect Millbank Penitentiary, prepared it in the following proportions, viz.: 700 lbs. of common salt, 700 lbs. of black oxide of manganese, and 1400 lbs. sulphuric acid. The salts were pounded together with a wooden mallet and placed on common earthen pans, before moistening with the acid, and the evolution of the gas continued for four days. For the efficient disinfection of large buildings, no agent has yet been found that is more reliable than chlorine, which acts as an antiseptic, by combining with the hydrogen of organic compounds, which it abstracts from and thus destroys them. Its disinfecting properties are largely due to its power of decomposing ammoniacal compounds. For its objections and relative efficiency see chlorine.—Also U. S. Patent 171. 332.

Gaseous Muriatic Acid was still earlier employed, for we find an account of its use by Guyton de Morveau in 1773 to disinfect a church in Dijon, which had become so contaminated by emanations from its vaults that it was unfit for service. Vinegar, aromatics, and the deflagrations of nitre had been tried, but without effect; but the vapor arising from the decomposition of six pounds of common salt by two of sulphuric acid deprived the air in one day of all unpleasant odors, and in four days afterward worship was performed. This distinguished philosopher towards the close of the same year, used fumigations of muriatic acid with complete success in disinfecting the prison of that city also, whither fever had been imported from other cities. The proportions

recommended are 12 parts of sulphuric acid to 15 parts of nitrate of soda, which should be slightly moistened before the acid is poured upon it.

Carbonic Acid Gas exists in the atmosphere as a product of combustion, and of the respiration of animals; it is a result, also, of the slow decomposition of most vegetable substances, and is evolved in great quantities from the ground in volcanic countries. In the fermentation of sugar it is produced in abundance, along with alcohol.

For the purpose of the chemist, it is generally prepared by decomposing marble by means of some stronger acid. From its cheapness and solubility of the residual salts, muriatic acid is generally employed.

The properties of carbonic acid are very remarkable; it is perfectly colorless and invisible; it is irrespirable, producing, when an attempt is made to breathe it, violent spasms of the glottis. If it be respired mixed with air, even in the proportion of one to ten, it gradually produces stupor and death, acting as a narcotic poison. Hence, when disengaged in large quantities, whether by natural operations or in process of manufacture, it accumulates in all cavities within its reach; and may cause fatal accidents to those who enter unadvisedly.

Carbonic acid does not support combustion; a taper plunged into a jar full of the gas is instantly extinguished. Carbonic acid is also a check on putrefaction, and arrests decay, for oxidation cannot take place in it. Hence it frequently has been proposed as a preservative and in a competitive trial of antiseptics made in Paris more than twenty years ago, carbonic acid and sulphurous gas were the most successful of all agents used.

Again in 1866 Mr. Shaler endeavored to introduce the use of dry and chemically pure carbonic acid gas, but as yet with very little favor.

Carbonic Dioxide and Monoxide Combined.—The deportment of beef in an atmosphere of carbonic acid, to which carbonic oxide has been added, is curious. A number of cylinders were filled in the usual way with such a mixture and opened at the end of two or three weeks; in each case the flesh had the smell and taste of good, pure meat, but it was not of the gray color which meat preserved in carbonic acid gas gradually takes. It appeared in the interior, as well as on the outside, of a bright flesh red color, and on the surface here and there, there were white round masses of fungoid growth of the size of a twenty-five-cent piece, which were removed with the slightest rubbing. The flesh lying just below these was found to have the same bright red color as that already described. Meat which had been for three weeks in such a gaseous mixture gave a broth, which, in good taste and freshness could hardly be distinguished from freshly made soup; and the boiled meats could not be distinguished either in appearance or taste. The property of carbonic acid to preserve meat suggests a use for the large supplies of this gas

evolved from the earth in many localities. Some manufacturers, taking as a basis the antiseptic properties of carbonic acid gas, have brought before the public a class of metallic goods styled self-embalming caskets. Theoretically, the principal is good; but the requirements of its practical usefulness are so numerous that the simple application of the gas outside of the body will, in a great majority of cases, prove ineffectual.

The caskets are provided, on the under part of the lid, with a receptacle, into which is introduced, through a vent hole in the lid, some marble dust and sulphuric acid; immediately upon the mixture of these two substances, carbonic acid is generated, which, being heavier than air, falls to the bottom of the casket, and displacing the air contained in the casket, drives it out, by means of its superior density, through the vent hole purposely left open in the lid of the casket. After the space of from ten to fifteen minutes, which is generally sufficient for the gas to replace the atmosphere contained inside the casket, the vent hole is closed with a rubber cork, fitting tightly, and the process of preservation thus ends. As we have stated before, the principle is good, but the practical result is very seldom satisfactory.

This generation of carbonic acid gas in an air-tight metallic casket, is a good auxiliary to the preservation of a body after this same body has been properly embalmed, inasmuch as it destroys effectually the oxygenation of the corpse. But the circumstances, morbid or otherwise, which modify the preservation of a body under different conditions, make it impossible to depend solely upon that means as being certain and efficacious. Dupre, as has already been mentioned employed in 1845 a mixture of carbonic acid and sulphurous gases a solution of which was successfully injected into the blood vessels of the body. Thus prepared bodies were preserved for days and it is said even for weeks. His exact formula is not given.

Sulphurous acid exists at ordinary temperature and pressure in the gaseous form; it is one, however, of the most easily liquified gases. It is produced always when sulphur burns either in air or in pure oxygen; sulphur not being capable of passing directly to a higher degree of oxidation. In the burning of sulphur, the volume of sulphurous acid gas formed is exactly equal to the amount of oxygen consumed. Sulphurous acid gas may also be easily prepared by heating three parts of flowers of sulphur with four of peroxide of manganese. The reaction is very simple; one part of the sulphur uniting with the metal, the rest with the oxygen, form sulphide of manganese, and sulphurous acid.

Sulphurous acid is absorbed by water. It is colorless and transparent, possessing an odor peculiarly irritating (the smell of burning sulphur) and cannot be breathed. Water dissolves about thirty-seven times its volume of sulphurous acid. The solution possesses the properties of the

gas in a very high degree, and bleaches vegetable colors with great power: when kept for some time it gradually absorbs oxygen, and the sulphurous becomes changed into sulphuric acid. The sulphurous acid is one of the feeblest acids, and is expelled from its combinations by almost all but the carbonic acid.

An embalming process, patented in New Jersey in 1880, consisted in removing the brains and intestines, filling the cavities with cotton, saturated with a compound of *saltpetre, sulphurous acid gas and water*, then closing the cavities, subjecting the body to the action of *sulphurous acid gas*, and finally steeping the body in the same compound.

Richardson's Ammonia is recommended by Richardson to dilate the bloodvessels, preparatory to the injection of other preservatives.

An atmosphere saturated with vapor of *ether, chloroform, bisulphide of carbon, prussic acid or benzine*, is said to preserve organic matter perfectly, if in an air tight vessel. Martin (1868) recommends as a temporary preservative to wrap the body in a sheet and place it in a lead coffin on a layer of bran, wool, cotton, tan, or even sand and sprinkle with two quarts of rectified sulphuric ether. Solder the lead coffin before closing the wooden one. Such a body would keep longer if the intestines were removed, and a substance substituted which readily absorbed the preservative liquid.

SOLUTIONS OF METALLIC SALTS.

These embrace our most valuable arterial preservatives whose injections nevertheless sometimes fail from the presence of clots in the arteries.

Salts of Alumina.—Many of these are used, most frequently perhaps of all, *alum* or the double sulphate of alumina and potash, or ammonia. (See *alum*.) Ordinary alum, according to Gamal, is an unprofitable method of preservation, for the reason, that a pound of alum solution contains but eighteen grains of alumina, hence he sought for other salts of alumina in which there should be a larger proportion of the base. His famous solutions varied in ingredients and in strength. One formula for injection consisted of equal parts of sulphate and chloride of aluminium, dissolved in water to a density of thirty-four degrees Beaumé. Dumas reported to the Academy of Sciences, Paris, in 1837, that *acetate of alumina*, obtained by the action of acetate of lead on sulphate of alumina and potash, dissolved in water, density eighteen degrees Beaumé, if five to six quarts were injected into the body, would preserve it five to six months.

The same salt of alumina obtained by the reaction of sulphate of alumina and acetate of lead, would preserve a body four months. Sulphate of alumina alone would preserve it two months. The density of the solutions of acetate and chloride of aluminium should be gradu-

ated by the state of the atmosphere. To preserve a body indefinitely, the solution should be twenty degrees Beaumé; a layer of varnish would prevent too rapid drying of the body.

Sulphate of Alumina (purified from iron), sixty parts, with water forty, and oxide of zinc six parts, dissolved and filtered, evaporated to a density of 1.35 (thirty-eight degrees Beaumé), has also been used.

Hyrthl of Vienna sometimes used, thirty-five p. c. alcohol, with a small addition of acetate of alumina (in one to twelve solution).

Salts of Zinc.—The chloride was first brought into prominence by Dr. Suequet in 1847, when a commission of the Academy of Medicine, Paris, reported favorably upon his process. A body which he had injected and had been buried for two years, was found on being disinterred to be as supple and perfect as if just placed in the coffin. The commission thought it might have been preserved indefinitely. He used a watery solution of chloride of zinc at forty degrees Beaumé; that is about thirty-five p. c. For injection it was diluted with one-fifth of its volume of water. He injected by the popliteal artery.

The French codex for 1856 recommends the liquefied chloride of zinc one part, distilled water two parts, dissolved and filtered. Density, 1.33 at 36 degrees Beaumé. A five p. c. solution injected into the carotid will preserve temporarily.

Straus-Dürkheim (1842) recommended the injection of a saturated solution of sulphate of zinc, as a permanent preservative.

Felhol and later Falconi proposed a concentrated solution. A solution of one part of the sulphate in two parts of water has been successfully used; a five per cent solution will preserve temporarily.

Dr. B. W. Richardson, London, (1875) recommends zinc colloid, or a solution of chloride of zinc dissolved in styptic colloid.

Salts of Mercury. *Corrosive Sublimate* dissolved in strong alcohol is one of the oldest and best methods of preserving (See Chaussier's method page 38), but it is both costly and dangerous.

Sauter (1885) recommends for temporary preservation, filling the coffin with woodwool charged with *corrosive sublimate*, one part in alcohol 100. Instead of woodwool, sawdust, bran, etc., may be used. The body should be previously washed with the solution diluted with ten parts of water.

Arsenical Salts.—Tranchini, of Naples, was probably the first to use arsenious acid as a preservative injection, employing for this purpose for each body two pounds of white arsenic, suspended in clear water, or dilute alcohol, colored with carmine. This is efficient, but it favors desiccation and is a very dangerous substance to handle. The same objection applies to the method of Worth and Durand.

This process, often employed in Europe, has given very satisfactory results, and seems to deserve attention.

The solution employed as an injecting fluid in this method is composed of arsenious acid, carbonate of soda and water. (See formula.)

The stomach is opened and emptied of its contents; the bowels, also, must be subjected to the same process. The trachea is punctured, and the bronchial tubes completely filled with the solution through the opening thus made. The stomach and intestines should be injected with the solution, and also the surrounding parts.

The right carotid artery is selected as the point of injection, instead of the left, for the following reasons: The right common carotid artery is shorter than the left; it is also anterior, and in consequence of proceeding from a branch, instead of from the main trunk, is larger than its fellow.

After the injection has proceeded upwards, until the arteries of the head and neck are filled, a very small puncture may be cut into the jugular vein, and the blood allowed to escape at that point until the flow decreases, when the veins may be tied up.

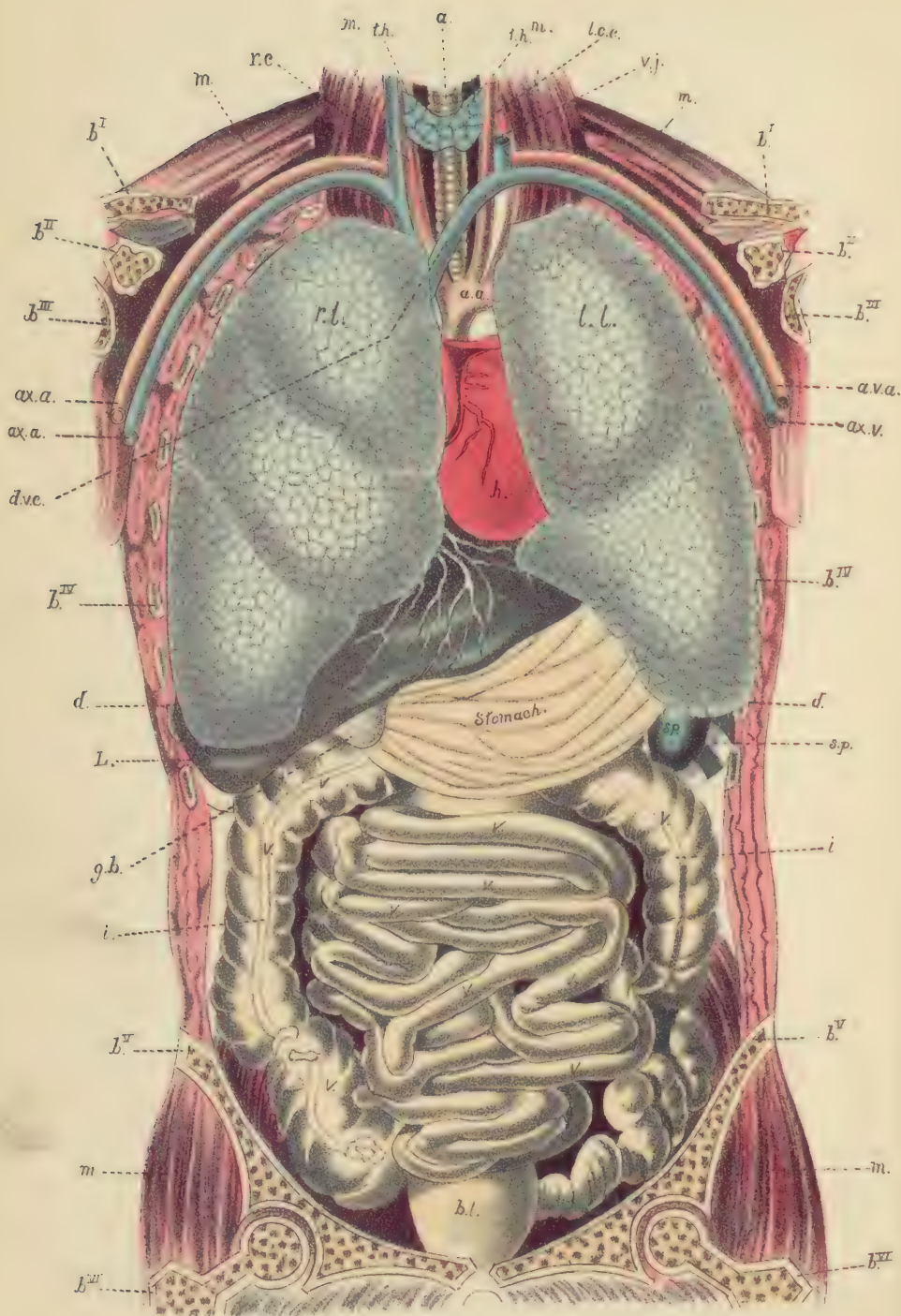
The nozzle of the injector is then turned in a downward direction and the injection continued until a sufficient quantity of the liquid has been injected. The artery is then neatly tied up and the wound brought together and sewed up.

Some of the same solution may also be poured around the bowels before and after their being replaced in their former position, and the opening in the abdomen is then closed.

Arsenious acid and arsenite of soda are forbidden by the French law, because of the medico-legal questions which would arise in case of suspected poisoning, but the substances are cheap and good preservatives. Seseman (1873) of St. Petersburg recommends injecting a solution of arsenite of soda and carbolic acid each in glycerine and water. For other preservative compounds containing arsenic see formulæ 5, 7, 25, 29, 33, 52, 73, 95, 98, 99, 100, 123, 133, 134, 135.

Hyposulphite of soda, saturated solution, will preserve bodies two to three months. It is better to wash out the bloodvessels first with water, and then inject the solution. By contact with the air, the hypsulphite is changed into the sulphate and loses its antiseptic power.

PLATE II.



(Explanation of Plate 2.)

- a.* Windpipe.
- b.* Cross-section of bone.
- h.* Heart (right ventricle).
- p.* Pulmonary artery.
- a. a.* Arch of the aorta.
- d. d.* Diaphragm.
- d. c. c.* Descending vena cava.
- l. c. c.* Left common carotid.
- c. c.* Right carotid.
- c. j.* Jugular vein.
- th.* Thyroid body.
- b¹.* Cross-section clavicle.
- b².* Cross-section of humerus.
- b³.* Cross-section of scapulæ.
- b⁴.* Cross-section of rib (removed in plate).
- b⁵.* Cross-section of pelvic bones.
- b⁶.* Cross-section of femur.
- r. l.* Right lung.
- l. l.* Left lung.
- st.* Stomach.
- l.* Liver.
- sp.* Spleen.
- i.* Intestines.
- c.* Small intestines.
- bl.* Bladder.
- m.* Muscles.
- ax. a.* Axillary artery.
- ax. v.* Axillary vein.
- g. b.* Gall bladder.

III. ORGANIC PRESERVATIVES.

Glycerine is a good preservative, but is comparatively expensive; a small quantity of arsenic may be added to it to prevent the mould appearing on a body after a time and also to prevent the attack of insects. It is stable, does not evaporate readily. The metallic salts, sugar, tannin, creosote, carbolic acid, or thymic acid may be added to it.

Howse (1871-76) of London, recommends glycerine and arsenic. Arsenious acid dissolves only in small quantity in cold glycerine; but if the latter be heated it will take up almost any amount; a pound of arsenic to a quart of glycerine is enough. Filter before using. The mus-

cles retain their red color for months; the skin gradually darkens. The total cost of injecting is about \$7.50.

Devergie announced to the Academy of Medicine, Paris, in 1869, that bodies injected with a mixture of glycerine and carbolic acid had been preserved several months without developing any odor. Packousky of Paris (1867) used a solution of glycerine, acetate soda, carbolic acid. (See Formulæ.) Seseman recommends replacing the acetate by the arsenite and to add ten parts of water. Sauter (1885) recommends injection of arteries with carbolic acid, glycerine, alcohol, water. (See Formulæ 68, 69.) He says it will preserve the body for several days. The surface of the body may be lubricated with vaseline or covered with varnish of sandarac to which one per cent of carbolic acid is added. The cavities of the body may be filled with sublimated wool. For other formulæ containing carbolic acid see Nos. 135, 134, 133, 92, 74, 68, 70, 5.

Creosote, etc. Any substance which requires much water for its solution is sure to fail; and it is probably that this is the reason that creosote in watery solution has not answered expectations. See Formulæ No. 22, 23, 24, 29, 33, 46.

The same is true of carbolic, salicylic, thymolic acid and other organic antiseptics, of which more can be learned under their appropriate section.

Chloral Hydrate, Dr. W. W. Keen, of Philadelphia, highly recommends (1875) this as a preservative. He says the body is perfectly preserved, has a life-like appearance, a pinkish skin, no blanching, shriveling, nor hardening. An impure chloral will do, and it is cheap. It has no odor. It does not destroy the clothing. Insects are not attracted. Without further particularizing we may say that all of the long list of antiseptics, ancient and modern are now used only according to modern methods *i. e.*, by injection of the arterial system with efficient antiseptics and disinfectants which percolate all the tissues from within outwards, instead of the earlier methods of maceration, packing the body in spices and imputrescible substances, which are inefficient and disappointing. Preservation by means of gaseous compounds has been discussed elsewhere, but for the present it is sufficient to say that in the preservation of the human body they have as yet failed to answer the expectations of those who have introduced them, besides being bulky and inconvenient to handle. The use of the refrigerator and ice have become almost as obsolete as the earlier methods of inclosing the body in a cask of Sherry or Madeira, for chemistry, during the last half century, has placed in the hands of the progressive funeral director a score and more of efficient antiseptics, so that the chief part of his labor today consists in the judicious selection of the chemical best adapted for the particular case under consideration. Whether it shall be in that particular case creosote, alcohol, tannin,

bichloride of mercury, the salts of iron, of zinc, of alumina, carbolic acid, arsenic, the protochloride of tin, thymol, glycerine, the borates, salicylic acid, etc., depends upon the requirements of the case, and these requirements can only be appreciated and properly met by one who has carefully studied the laws of chemistry and the composition of the human body. Here, as elsewhere, knowledge is power, and an ignorant embalmer must certainly meet with humiliating failures which a wider knowledge would have enabled him to overcome, or still better anticipate. For this knowledge it is requisite that he should have a good acquaintance with the human body, its more important parts and especially its landmarks. As these are indispensable prerequisites to all scientific embalming, we shall endeavor in the next section of this work to review succinctly the histology and morphology of the human body, in so far as it is necessary for the practical undertaker. Having briefly reviewed these we shall then be in a position to consider understandingly the whys and wherefores of the best modern methods and how they should be modified to meet the various exigencies that may arise. Without this, embalming can be nothing more than rule of thumb, but with this comprehensive knowledge it becomes the crowning achievement of a profession which requires for success the wisdom of the anatomist, the skill of the surgeon, and the untiring patience and ingenuity of the chemist.

SECTION II.

- A. THE MORPHOLOGY, HISTOLOGY AND ANATOMY OF THE HUMAN BODY, SO FAR AS REQUIRED FOR THE EMBALMER'S ART.
- B. PROOFS OF DEATH.
- C. METHOD OF MAKING AN AUTOPSY.

SECTION II.

A. THE MORPHOLOGY HISTOLOGY AND ANATOMY OF THE HUMAN BODY, SO FAR AS REQUIRED FOR THE EMBALMER'S ART.

" *The normal man's weight is 154 pounds, made up as follows: Muscles and their appurtenances, 68 pounds; skeleton, 24 pounds; skin, 10½ pounds; fat, 28 pounds; brain, 3 pounds; thoracic viscera, 3½ pounds; abdominal viscera, 11 pounds; blood which would drain from the body, 7 pounds. The heart of such a man should beat 75 times a minute, and he should breathe fifteen times a minute. In 24 hours he should vitiate 1,750 cubic feet of pure air to the extent of one per cent. He would throw off by the skin 18 ounces of water, 300 grains of solid matter, and 400 grains of carbonic acid, every 24 hours; and his total loss during that period would be 6 pounds of water and a little more than 2 pounds of other matter.*" *Huxley.*

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Bellamy's Surgical Anatomy,
Klein's Histology,
Virchow's Post Mortem Examinations,
Tidy's Forensic Medicine,
Huxley's Physiology,
Roser's Vademecum,
Clarke's Text Book on Embalming,
Renouard's Undertaker's Manual,
Weiss' Anatomy.

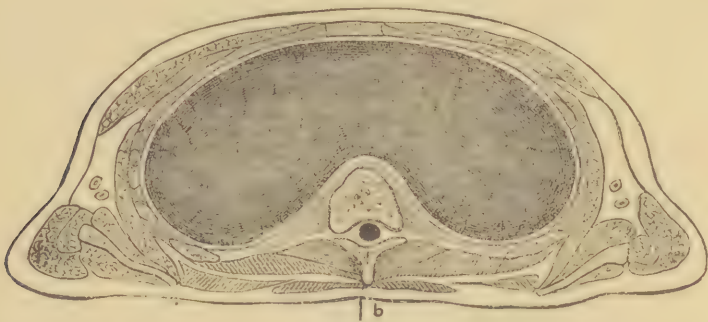
MORPHOLOGY AND PHYSIOLOGY OF THE HUMAN BODY.

The human body may be studied either morphologically, that is as regards its shape, or histologically, or as regards its structure. A minute knowledge of the anatomy or of the histology of the human body can only be acquired by the labor of a lifetime, but such knowledge is only necessary for the learned anatomist or histologist.

The practical funeral director requires a good general knowledge of the parts of the body, and a special knowledge of their microscopic structure only so far as it will assist him to a better knowledge of the changes produced by disease, and to more scientific methods of preservation. But neither of these can he ever have without that study and weariness of the flesh which Solomon declares is inseparable from all wisdom. Hence much that appears in this section may seem to be dry and wearisome in its detail, notwithstanding great pains has been taken to omit all that seemed to have no direct bearing upon the purpose of this work. Possibly much of it is already known to the progressive funeral director, but where this is occasionally true, the cases where a more intimate knowledge of the human body is not greatly needed are exceedingly exceptional. Line upon line is as necessary here as elsewhere, for that accurate knowledge upon which alone scientific embalming can exist.

Shakspeare likens man to a "forked radish with a head fantastically carved upon it." Huxley, less poetically and more truthfully says the human body is essentially a compound tube, or parallel tubes of very unequal caliber, as may be seen by the accompanying cross section, made just below the shoulders.

FIGURE 1.

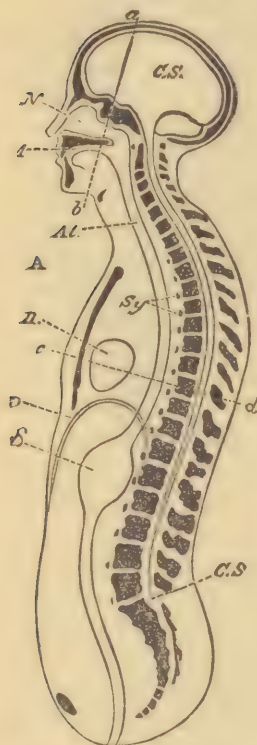


Cross section of thorax at the level of the shoulders. (a). Thoracic cavity. (b). Vertebral cavity.

(a). The anterior tube is the cavity in which the lungs are contained, and (b) is the much smaller posterior tube in which the spinal cord is safely encased. The relative proportion between the anterior and dorsal tubes is about as represented, with the exception of the head, where we find the relative size of the tubes reversed, and the posterior cavity which contains the brain much larger than the anterior or buccal cavity. This is well shown in cut 2, which represents a longitudinal section of a human body made down an imaginary perpendicular line, called the axis, dividing the body lengthwise into two exact halves, as it were by a great

knife. Such a section would exhibit the cut surface of thirty-three bones bound together into a long column which lies much

* FIGURE 2.



nearer the back than the front aspect of the body. This is called the spinal column, its separate bones, vertebræ, and the canal which they inclose, the spinal canal. This spinal canal contains a long white cord, known as the spinal cord, which is a prolongation of the brain and a no less important part of the nervous system. As may be inferred from the above, the brain also lies in the dorsal tube, or rather the upper portion of it, which is expanded to form the skull, or brain case (See Fig. 2), which with its contents constitutes the larger portion of the head. The brain, like the rest of the human body, is made of two symmetrical halves (joined together by a stout band, the corpus callosum figure 3), after the fashion of the late Siamese twins. The consistence, color, and general appearance of the surface of the brain is very like that of well cooked and stirred hasty pudding. It is not, however, a solid body, but contains within it four cavities which are known as ventricles (See Fig. 3. v. v. v-v.) and which are filled with a watery fluid, (See Chemistry of the Human Body for composition of cerebro-spinal fluid), which bathes both the surface of the

brain, its ventricles, the spinal cord, and acts as a watercushion or bumper, to prevent these soft structures from receiving injuries from sudden blows or jolts. The brain itself is scarcely firmer in consistence than blanc mange, to which it has frequently been likened. When cut into, its grayish appearance is confined to a thin layer upon its outer surface. (See Fig. 3.) Internal to this we have what is known as the white substance of the brain; the grey is known as its cortex. Under the microscope these tissues are shown to be made up of myriads of "little star-like bodies (nerve cells) connected by innumerable millions of pellucid threads." If the nerve cells largely predominate, we have what is known as the grey nerve matter; if the threads, the white

*A, a diagrammatic section of the human body taken vertically through the median plane. C. S. the cerebro-spinal nervous system; N, the cavity of the nose; M, that of the mouth; AL, AL the alimentary canal represented as a simple straight tube; H, the heart; D, the diaphragm; Sy, the sympathetic ganglia.

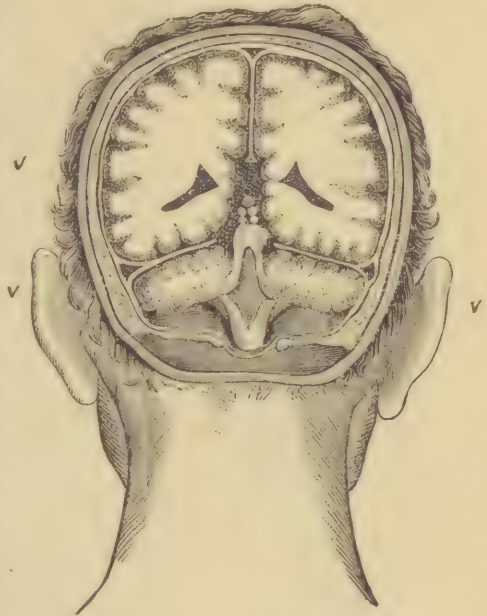
blanc mange like substance already mentioned. These two kinds of nerve matter are found in all nerves, great or small, for we find in them both grey and white nerve substance. To the naked eye a nerve looks like a bit of wet, white cotton thread of varying size. Under the microscope it becomes a series of concentric cylinders, the innermost of which is known as the axis (*a*) a pale, faintly fibrillated band or cylinder known as the grey substance of Purkinje.

This has a very delicate transparent sheath (*b*), and external to this we find the white substance of Schwann (*c*) analogous to the

white substance of the brain, and in turn has its external sheath or neurilemma.

During life the axis cylinder is in a semi-fluid condition like half-melted fat which cools and solidifies after death. Through this passes nerve force whatever that may be, and wherever gray matter is found there apparently nerve force is generated. This is done not alone in the gray matter of the brain and spinal cord but also in little nerve knots or ganglia (See Fig. 5.), which act the part of minor brains and are placed where is needed no conscious thought for action to carry on the functions of the body. There are for instance twelve or fifteen of these in the heart and their duty is to see that the heart beats regularly day and night without troubling the brain about it. Fig. 1 shows the long double series of these knots or ganglia, lying in front of the back bone for nearly its whole extent. These are known as the sympathetic ganglia, or sympathetic

FIGURE 3.



Cross-section of the skull and brain, made just behind the ears, showing the ventricles, corpus callosum, cerebrum and the longitudinal and transverse sinuses.—From Rosers' Vademecum.



Fig. 4. Medullated Nerve-fibres.

A, B, showing on a surface view the reticulated nature of the medullary sheath; C, two nerve-fibers showing the axis cylinder, the medullary sheath with their vertically-arranged minute rods, and the delicate neurilemma or outer hyaline sheath. (Atlas.)

nervous system. This involuntarily regulates all the functions of the body. Blushing, chill, heat, fever and inflammation are all under the control of this system, and in fact a very large proportion of all of the work done by the body is done under the direction of this part of the nervous system. These sympathetic nerve fibers are generally non-medulated and are connected both with ganglia and the spinal nerves, and follow in general the line of blood vessels whose size they regulate. In the thorax and abdomen they form great networks, or plexuses as they are called about the heart and stomach. See cut 6. Consequently there are two systems of nerves; one called the "cerebro-spinal" and the other the "sympathetic, or organic nervous system." The latter is involuntary and presides over the functions of animal life, in other words

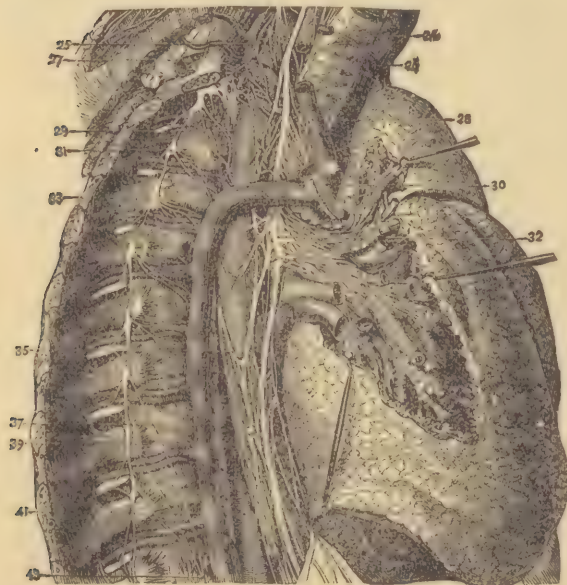
FIGURE 5.



SYMPATHETIC GANGLION CELL OF MAN.

The ganglion cell is multipolar; each process receiving a neurilemma from the capsule of the cell becomes a non-medulated nerve-fiber.

FIGURE 6.

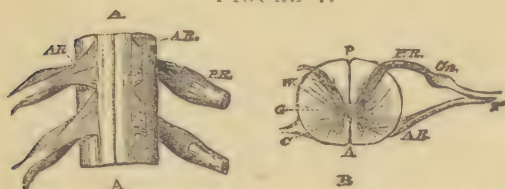


it is the system of nerves that run the machinery of the body. The circulation, etc., as has already been said, is controlled by this system of nerves. In regard to the other, the cerebro-spinal nervous system is composed of two kinds of nerves, viz.: the nerves of motion which in a normal state are controlled by the will, and the nerves of sensation.

During suspended animation

and catalepsy it would seem that only the nerves of motion are absolutely dormant from the fact that suffering and pain are caused by the use of electricity. During this suspension of the cerebro-spinal system the organic, or sympathetic system still continues to perform its work in a less active degree, until sooner or later stimulus is again imparted to the motor nerves, and motion is re-established in all the muscles of the body giving power to move and speak. The different functions of the cerebro-spinal nerves is well illustrated in the annexed cut, which represents a horizontal section of the spinal cord through the anterior and posterior nerves at the same level. There are thirty-one pairs of these spinal nerves, and consequently twice as many roots given off in two lateral series from each half of the cord. Like the brain the spinal cord is made up of white and grayish nerve matter, the white matter being external and the gray arranged somewhat like a pair of crescents back to back with their tips or cornua prolonged to form the anterior (*A.R.*) and posterior (*P.R.*) spinal nerves which soon

FIGURE 7.



The Spinal Cord.—A. A front view of a portion of the cord. On the right side the anterior roots, *A.R.*, are entire; on the left side they are cut, to show the posterior roots, *P.R.* B. A transverse section of the cord. *A*, the anterior fissure; *P*, the posterior fissure; *C*, the central canal; *G*, the grey matter, *W*, the white matter; *A.R.*, the anterior root. *P.R.*, the posterior root, *Ga*, the ganglion, and *T*, the trunk, of a spinal nerve.

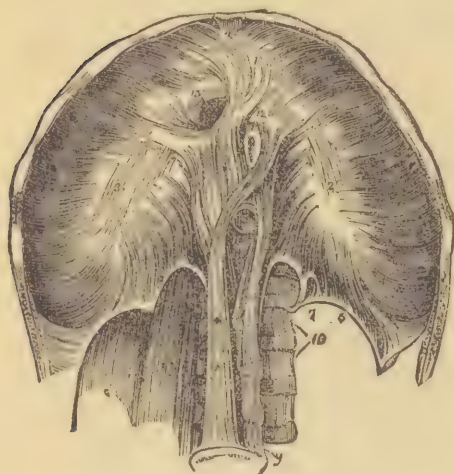
after leaving the cord unite to form a common nerve trunk. Years of patient experimentation have at last proven that the functions of these two component parts of the spinal nerves are widely different, viz.: the fibers arising from the anterior roots are motor and those originating from the posterior roots are sensory, or in other words, all the power that the spinal nerves have to produce muscular contractions lies in the fibers of the anterior roots, and all of their sensory powers reside in the posterior roots and ganglia which act independently of the brain. In fact, the spinal cord may be considered a series of tiny, or minor brains, 32 of which are piled one atop of another. It would be interesting to study each of these more in detail, but it must be remembered that here we seek only such general knowledge of the nervous system as is necessary for a general acquaintance with the human body. The nervous system might be likened to the battery and wires of an electro-motor, of which the body represents all the other parts, and no piece of human machinery has ever yet been so exquisitely constructed as the rounded box with motors and locomotors, which we call the body.

This box proper, or *trunk* of the body as it is generally known, is made up of the ribs, spinal column, pelvis, and the various muscles

affixed to them, and extends from the shoulders to the groins. It consists, as has already been said, of a bony framework, to which the limbs and muscles are attached and contains within it two cavities of nearly equal size, viz.: the thoracic and abdominal. See cut 1. The entrance to both of these cavities is through the mouth, and it should always be remembered that the opening to the thoracic cavity lies in front of that to the stomach, or abdominal cavity. See cut 2, page 57. Fuller directions in regard to the precautions to be observed to enter the oesophagus instead of the windpipe will be given in the section on the methods of embalming, for the present section embraces only a description of the abdominal and thoracic cavities proper.

These cavities are separated one from another by an elastic partition or *diaphragm*. (A. A. See plate II.) This diaphragm is really a fan-shaped muscle with its handle toward the backbone.

FIGURE 8.



1. The central leaflet of the tendinous center.
2. The left or smallest leaflet.
3. The right leaflet.
4. Fasciculus from the ensiform cartilage.
5. Ligamentum arcuatum externum of the left side.
6. Ligamentum arcuatum internum.
7. A small arched opening occasionally found, through which the least splanchnic nerve passes.
8. Right crus.
9. Fourth lumbar vertebra.
10. Left crus.
11. Aortic opening.
12. Oesophageal opening.
13. Opening for the inferior vena cava.
14. Psoas magnus passing beneath the ligamentum arcuatum internum.
15. Quadratus lumborum passing beneath the ligamentum arcuatum externum.

Its front edge is attached to the sternum or breastbone, and its sides slope downward and are fastened to the lower six ribs (Heath). Consequently it does not form a horizontal partition but arches upward on either side in shape not unlike a policeman's helmet, but unlike that in it is not stiff but exceedingly flexible, changing its position with every inspiration and expiration.

The diaphragm is perforated with three large openings, viz.: The aortic (11), through which pass the aorta, thoracic duct and the vena azygos major; second, the caval (13), further front, through which the vena cava inferior passes, and thirdly the oesophageal (12) through which the oesophagus and the vagi nerves descend.

The position of the diaphragm during respiration depends somewhat upon the size

of the abdominal viscera in immediate contact with it, viz.: the stomach, intestines, and liver. During normal expiration its right arch ascends to the level of the fifth rib. Forced expiration brings it to a level with the right fourth costal cartilage in front, with the fifth, sixth and seventh ribs on each side and with the eighth rib behind, while the left arch of the diaphragm is always lower than the right by two ribs. During forced inspiration, the diaphragm descends to a line extending from the ensiform cartilage to the tenth rib. (Fig. 9.) Its position after death is usually arched, being concave toward the abdomen, particularly on the right side, as expiration is usually the last vital act, but its exact position depends upon the relative size and condition of the abdominal organs. Gaseous distension of the stomach and intestines may push it upwards to its highest limits of forced expiration, but being fastened as it is on all sides to bony structures it cannot rise beyond this, unless ruptured. As has already been said, this diaphragm divides the great cavity of the trunk into two others, known as the thoracic and abdominal. (Plate II.)

THE THORACIC CAVITY.

The thoracic cavity, or chest, as it is usually called, lies entirely above the diaphragm, and contains the right and left lungs and between them the heart and great vessels soon to be described. Their approximate situation may be fixed by remembering that a bullet would pierce the heart if it entered the chest at a right angle just above the fifth rib and to the middle line just above the left nipple. A wound exactly in the middle line would also involve the heart and great vessels, and to the right would escape the heart but pass through the right lung. A knife thrust into the lower intercostal spaces would wound the base of the lung during inspiration, but if done during expiration the lung itself might escape injury. (See Figure 9.)

THE LUNGS.

The lungs, as may be seen from plate I, lie immediately below the windpipe and are spongy organs admirably designed to allow the external air to come in close proximity to the blood circulating through them. They are placed in the thorax, or chest, each lung enclosed in a tough sack called the pleura. Each pleura is a closed sack, one holding the right lung and the other the left and not communicating one with another. The two pleurae do not meet in the middle line of the chest except at one point in front, consequently an interspace is left between, which is called the mediastinum and which contains all the viscera of the thorax except the lungs. The point at which the pleurae touch is a little above the middle of the breastbone, a fact which should be remembered when it is desired to enter the mediastinum or the heart via this route.

In the cavity of the pleurae we find the lungs, which extend from 1 to 1½ inches above the collar bones to the diaphragm, or from the root of the neck to the sixth and seventh ribs. The broad concave bases of the lungs rest upon the convex surface of the diaphragm (See figure 9), the thin lower edges of the lungs, fitting accurately into the wedge-like space between the ribs and the diaphragm. The lungs are of unequal size, somewhat conical in shape and lie in the right and left sides of the thorax respectively, the base of the right lung being considerably hollowed out by the bulging upward of the liver, which projects upward as far as the fifth rib; the base of the left lung is also concave, though to a less degree by the upward projection of the stomach, spleen and left lobe of the liver.

See annexed diagram, cut 9.

FIGURE 9.

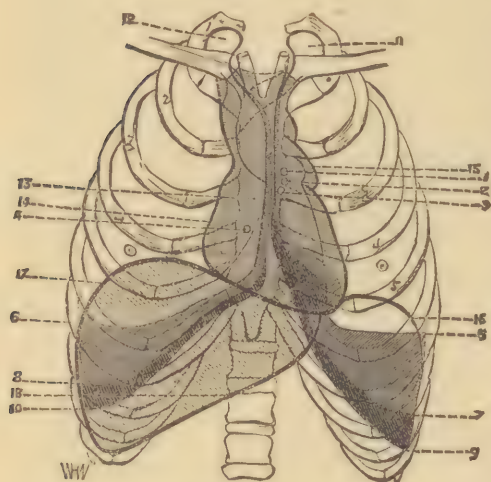


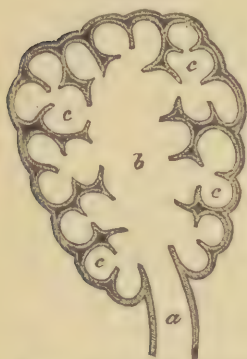
Diagram of the relations of the thoracic viscera to the walls of the chest (altered from ANGER). 1. Situation of pulmonary orifice. 2. Left auriculo-ventricular orifice. 3. Orifice of aorta. 4. Right auriculo-ventricular orifice. 5. Limit of the anterior and inferior border of left lung in complete expiration. 6. Ditto of right lung. 7. Limit of left lung in inspiration. 8. Ditto of right lung in inspiration. 9. Limit of pleura. 10. Ditto. 11. Superior cul-de-sac of left lung. 12. Ditto of right lung. 13. Right auricle. 14. Right auricular appendage. 15. Left auricle. 16. Limit of diaphragm in complete expiration. 17. Ditto, ditto. 18. Ditto, ditto, in complete inspiration.

The right lung is the larger and broader, owing to the inclination of the heart to the left side. It is shorter than the left lung by about two inches, owing to the projection upward of the liver upon the right side. It has three lobes, while the left lung has but two. What is known as the root of the lung is the collection of vessels by which each lung is connected to the heart and trachea. Each root is made up of the bronchial tube, the pulmonary artery, the bronchial arteries and veins, and the pulmonary nerves lymphatics and glands, enclosed in a reflection of the pleura. The weight of the right lung is about two ounces greater than the left, and together they weigh about forty-two ounces; at birth their color is pinkish; in adult life they have a dark slate color,

growing darker with age. The surface of the lungs is smooth, shining and marked with numerous polyhedral spaces corresponding to the lobules of the organ and the area of each of these is crossed with numerous

lighter lines. The substance of the lungs is light, spongy and porous, so that it floats on water and crackles when handled, owing to the air in the interstices of its lobules. Each of these lobules contains one of the branches of the bronchial tubes with its terminal air cells, vessels and fibrous tissue holding them together. These air cells are blind pouches in which the subdivisions of the bronchi terminate, and it will be remembered that the bronchi are branches or prolongations of the wind-pipe, which, under the name of main bronchus, enters the lungs and divides and subdivides into smaller bronchi, right and left until, as has already been said, each of these bronchioles terminates in an air cell, or alveolus, as it is sometimes called.

FIGURE 10.

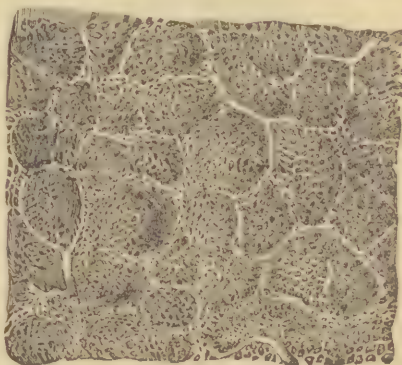


Single Lobule of Human Lung. *a*, Ultimate bronchial tube. *b*, Cavity of lobule. *c*, *c*, *c*, Pulmonary cells, or vesicles.

The form of these air cells is well-shown in the annexed cut, which gives a cross-section of one of these ultimate bronchioles and its terminal vesicles. Each of these is held in a network of capillaries, which inclose each alveolus the lungs in a sort of basketwork of blood vessels. Each air cell measures only about one seventy-fifth of an inch in diameter, but as there are estimated to be 18,000,000 of these air cells, their combined surface amounts to more than two hundred square yards, or more than fifty times the extent of the surface of the body. Through this thin film of tissue, exposed to the air on both sides, the entire amount of blood in the body flows three times in a minute, requiring for its aeration 12,000 quarts of air daily. The chemical changes which

occur in the blood in consequence will be described in detail under the head of Chemistry of the Body, but it should also be remembered that these air cells are riddled with stomata, or minute openings into the lymphatic spaces. See Lymphatic vessels and figure 11. from Klein, which beautifully shows these openings as they appear during inspiration, when they are most distinct. Through these openings bits of soot and other foreign matters, which acci-

FIGURE 11.



dentally pass into the lungs find their way into the lymphatics, and through these probably also come in part the frothing and blubbing from the mouth observed after death. The walls of these alveoli are made up of the blood vessels already mentioned and yellow, elastic tissue, which gives these air cells their elasticity and strength. An adult in health breathes about fifteen times to a minute, and each act consists first, of inspiration, or a drawing in of the breath; second, of expiration or driving it out again; and third, these acts are then followed by a short pause. Each inspiration of an adult draws in about thirty cubic inches of air, and a chemical examination of the expired air will show that it differs very materially from that which has just been inspired. Its chief difference lies in its loss of oxygen and its substitution by carbonic dioxide gas; about eighteen cubic feet of the one being exchanged for the other, or, as Huxley puts it: "If a man be shut up in a close room, having the form of a cube seven feet each way, every particle of air in that room will have passed through his lungs in twenty-four hours, and a fourth of the oxygen it contains will be replaced by carbonic acid gas." This exchange of gases takes place directly through the cell walls by a process to which the name of *osmosis* has been given, and of which more will be said under the head of the Chemistry of the Body, but for the present it is sufficient to remember that this change takes place with each breath in each of the eighteen million air cells of the lungs, and that during the day we breathe in and out about thirty-three hogsheads of air. (See Chemistry of the Body.)

This ceaseless exchange, for it goes on whether we sleep or wake, would purify only the blood contained in the capillaries of the lungs were there no contrivance for constantly changing the blood. This, however, is done every sixteen seconds by means of the heart, a no less important organ than the lungs themselves.

THE HEART.

The heart is a hollow, muscular organ about the size of an adult's fist, of conical shape, located between the right and left lungs, its apex lying about an inch and a half from the surface of the body.

It is inclosed in a fibrous sack, called the pericardium, and lies obliquely in the chest and so placed that a bullet penetrating the breast-bone on a level with the nipple and striking the vertebræ at right angles with the axis of the body, would pass through three cavities of the heart, viz.: both right and left ventricles and the left auricle.

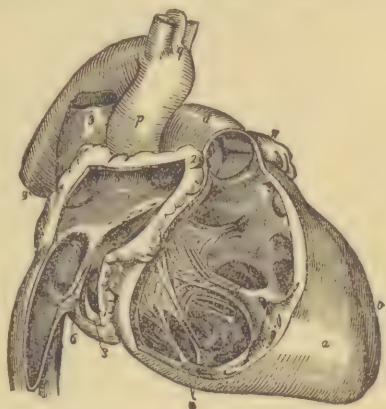
Its base, or broad end, is directed upwards and backwards toward the right and corresponds to the interval between the fifth and eight dorsal vertebræ. Its apex or conical end is directed forward and to the

left, and corresponds to the interspace between the cartilage of the fifth and sixth ribs, one inch to the inner side, and two inches below the left nipple. The heart is placed behind the lower two-thirds of the sternum or breast-bone, and projects further into the left than into the right cavity of the chest, extending from the median line about three inches to the left, and only one-half an inch to the right. Its upper border would correspond to a line drawn across the sternum, on a level with the upper border of the third costal cartilages; and its lower border, to a line drawn across the lower end of the gladiolus, from the costodiphoid articulation of the right side, to the point formerly mentioned as the situation of the apex. The lungs cover the greater part of the heart, especially during inspiration, at which time their borders nearly meet behind the sternum. A thin layer of lung tissue covers the roots of all the large vessels, but a considerable portion of the heart is always uncovered by the lungs where they recede from one another.

This "area of heart's dullness," as it is commonly called, is said by Mr. Holden to be indicated, roughly, but sufficiently for practical purposes, by a circle one inch in radius, the center of which is midway between the nipple and the end of the sternum. The anterior surface of the heart is rounded and convex, directed upward and forward, and formed

FIGURE 12.

RIGHT SIDE OF THE HEART LAID OPEN.



1. Cavity of right auricle.
2. Appendix auriculæ; in its cavity are seen the muscoli pectinati.
3. Superior vena cava, opening into the upper part of the right auricle.
4. Inferior vena cava.
5. Fossa ovalis; the prominent ridge surrounding it is the annulus ovalis.
6. Eustachian valve.
7. Opening of the coronary sinus.
8. Coronary valve.
9. Entrance of the auriculo-ventricular opening. Between the figures 1 and 2, two or three foramina Thebesii are seen.
- a. Right ventricle.
- b. Cavity of right ventricle.
- c. Conus arteriosus or infundibulum.
- d. Pulmonary artery.
- e, f. Tricuspid valve; e is placed on the left curtain, f on the anterior curtain.
- g. One of the muscoli papillares, to the apex of which the anterior and right curtains are connected by the chordæ tendinæ.
- h. Columnæ carnæ.
- i. Two muscoli papillares of the right curtain.
- k. Attachment by chordæ tendinæ of the left limb of the anterior curtain.
- l, l. Chordæ tendinæ.
- m. Semi-lunar valves of the pulmonary artery.
- n. Apex of left appendix auriculæ.
- o. Left ventricle.
- p. Ascending aorta.
- q. Its transverse portion, with the three arterial trunks which arise from the arch.
- r. Descending aorta.

chiefly by the right ventricle and part of the left. Its posterior surface is flattened and rests upon the diaphragm, and is formed chiefly by the left ventricle.

The right border of the heart is long, thin, and sharp; the left border short, but thick and round.

The heart, in the adult, measures five inches in length, three inches and a half in breadth in the broad part, and two inches and a half in thickness. The average weight, in the male, varies from ten to twelve ounces; in the female, from eight to ten; its proportion to the entire weight of the body being as 1 to 169 in males; 1 to 149 in females. The heart continues increasing in weight, and also in length, breadth, and thickness up to an advanced period of life; this increase is more marked in men than in women.

The heart (See Fig. 12.) is divided by a longitudinal, muscular septum, or division, into two lateral halves which are known from their position as the right and left heart, and each of these is again subdivided by a transverse wall into two cavities known as right and left auricles and ventricles, respectively; the upper cavities on each side being called auricles, from their fancied resemblance in shape to an ear. The lower cavities are known as the right and left ventricles, according to their position. The right is the venous side of the heart, receiving into its auricle the dark, or venous, blood of the body through the venæ cavæ which empty into it. The course of the blood from this point is as follows: This venous blood passes downwards through the tricuspid valve (*e. f.*) from the right auricle into the right ventricle, whence it is propelled by the contraction of the heart into (*d*) the pulmonary artery, its return into the auricle being prevented by means of the tricuspid valve just mentioned, and its regurgitation from the pulmonary artery back into the ventricle is similarly prevented by semi-lunar valves (*m*) placed at the cardiac orifice of the artery. By the pulmonary artery the blood, still blue and venous, reaches the lungs where it loses its dark color by the process already described, and now becomes bright red. Having been thus purified, it returns to the heart from the lungs through the pulmonary veins which empty into the left auricle of the heart. (See Plate VI.) These veins have no valves at their openings into the left auricle, and, consequently, there is a slight reflux of blood toward the lungs with each contraction of the heart, but the greater part of the blood in the left auricle is forced by each impulse of the heart through the mitral valve (*M.V.*), lying between the left auricle and ventricle, into the latter, whence by the next contraction of the heart it is forced past the semi-lunar valves, at the ventricular orifice of the aorta into the aorta. The aortic semi-lunar valves prevent the return of the blood into the left side of the heart, and, consequently, it is carried onward through

the blood vessels until it reaches the arterial capillaries, and from them it percolates into the venous capillaries, and thence into the larger veins, and ultimately into the venæ cavae, from whence, as we have seen, it passes into the right side of the heart, where it again begins the round just described (See Plate VI.) through the arteries, veins and heart. The channels through which this is accomplished well deserve the careful study of the practical embalmer, for they are those through which he must accomplish his ends, hence some little space must be given to

THE BLOOD VESSELS.

These are of two varieties, viz.: arteries and veins. The arteries are cylindrical vessels which convey away the blood from the ventricles of the heart. They were originally called arteries from the idea entertained by the ancients that these vessels contained only air, which mistake arose from the fact the arteries are usually found empty after death. Galen was the first to refute this opinion, for as early as his day he was able to prove that the arteries contain blood in the living body. Except in the case of the pulmonary artery, the blood they contain is the bright red, or well aerated. The pulmonary artery, as may be remembered, although it is called an artery, conveys venous blood from the heart to the lungs whence it is returned by the pulmonary veins to the other side of the heart. (This constitutes what is known as the lesser or pulmonary circulation.)

The greater, or general systemic circulation, begins in the aorta or the greater artery which arises from the left ventricle and by its various subdivisions supplies arterial blood to all parts of the body, whence it is gathered up again by the veins and carried back to the right side of the heart. The ramifications of the systemic arteries resemble an inverted tree whose common trunk would be represented by the aorta and its twigs by the arterial capillaries of the surface of the body.

The capillary arteries are found in nearly every part of the body with exception of the hair, nails, epidermis, cartilages and cornea. The larger trunks usually occupy the more protected situations, running in the limbs along the flexor side, since they are there less exposed to injury. There is considerable variation in the mode of division of the arteries; occasionally a short trunk subdivides into several branches at the same point, as we observe in the celiac and thyroid axes; or the vessel may give off several branches in succession, and still continue as the main trunk, as is seen in the arteries of the limbs. The usual division is dichotomous or double, as for instance, the aorta divides into the two common iliaes; and the common carotid, into the external and internal carotids.

The arteries in their distribution, communicate freely with one

another, forming what is called anastomosis, or inosculation. This communication is very free between the large as well as between the smaller branches. Anastomoses between trunks of equal size are found wherever great freedom and activity of the circulation are requisite, as in the brain; here the two vertebral arteries unite to form the basilar, and the two internal carotid arteries are connected by a short communicating trunk; this is also found in the abdomen, the intestinal arteries having very free anastomoses between their larger branches. In the limbs the anastomoses are more frequent and of larger size around the joints; the branches of an artery above freely inosculating with branches from the vessels below; these anastomoses are of considerable interest to the surgeon, as it is by their enlargement that a collateral circulation is established after the application of a ligature to an artery for the cure of aneurism. The smaller branches of arteries anastomose more frequently than the larger; and between the smallest twigs, the inosculations become so numerous as to constitute a close network that pervades nearly every tissue of the body.

The arteries are dense in structure, of considerable strength, highly elastic, and when divided they preserve, although empty their cylindrical form. They possess three coats, viz.: 1st. Internal, or endothelial; 2d. Fibrous, or circular. 3d. The external. The two inner coats are very easily separated from the external one, as is done in the ordinary operation of tying a ligature on an artery. If a fine string be tied forcibly upon an artery, either before or soon after death, and then be taken off, the external coat will be found uninjured, but the internal coats are divided in the track of the ligature, and can be easily dissected from the outer coat. The inner coat can be separated from the middle by a little maceration, or rubbing between the fingers.

The arteries, in their distribution throughout the body, are included in a thin areolo-fibrous investment, which forms what is called their sheath. In the limbs, it is usually formed by a prolongation of the deep fascia, in the upper part of the abdomen, in the neck, of a prolongation of the deep cervical fascia. The included vessel is loosely connected with its sheath by a delicate areolar tissue, and the sheath usually encloses the accompanying veins, and sometimes a nerve. Some arteries, as those in the skull and brain, are not included in sheaths. All large arteries are supplied with blood-vessels like all other organs of the body.

These nutrient vessels arise from a branch of the artery or from a neighboring vessel, at some considerable distance from the point at which they are distributed. They ramify in the loose external and middle coats; according to Arnold and others, supply also the internal coat. Minute veins serve to return the blood from these vessels; they empty themselves into the accompanying veins.

The veins are the vessels which serve to return the blood from the capillaries of the different parts of the body to the heart. They consist of two distinct sets of vessels viz: the pulmonary and systemic veins.

The veins, like the arteries, are found in nearly every tissue of the body. They commence by minute plexuses which communicate with capillaries. The branches which have their commencement in these plexuses unite together into trunks, and these in their passage towards the heart constantly increase in size as they receive branches, and join other veins similar in size to themselves. The veins are larger and altogether more numerous than the arteries: hence the entire capacity of the venous system is much greater than that of the arterial. The pulmonary veins are exceptions, for they do not exceed in capacity the pulmonary arteries. From the combined capacity of the smaller venous branches being greater than the main trunks, it results that the venous system represents a cone, the summit of which corresponds to the heart, its base to the circumference of the body. In form the veins are not perfectly cylindrical like the arteries, their walls being collapsed when empty and the uniformity of their surface being interrupted at intervals by slight contractions, which indicate the position of the valves, in the interior of the veins. They usually preserve, however, the same caliber as long as they receive no branches.

The veins communicate very freely with one another, especially in certain regions of the body, and this communication exists between the larger trunks as well as between the smaller branches. Thus in the cavity of the cranium and between the veins of the neck, where obstruction would be attended with imminent danger to the cerebral venous system, we find that the sinuses and larger veins have large and very frequent anastomoses. The same free communication exists between the veins throughout the whole extent of the spinal canal and between the veins composing the various venous plexuses in the pelvis.

Most veins are provided with valves which serve to prevent the reflux of the blood. These valves are formed by a reduplication of the inner and a part of the middle coat of the vein, and consist therefore of connective tissue and elastic fibers, covered on both surfaces by epithelium. Their form is semi-lunar. They are attached by their convex edge to the walls of the vein; their concave margin is free, direct in the course of the venous current, and lies in close opposition with the wall of the vein so long as the current of blood takes its natural course; if, however, any regurgitation takes place, the valves become distended, their opposed edges are brought into contact and the current of blood is intercepted. Most commonly two such valves are found placed opposite one another, especially in the smaller veins and in the larger venous trunks at the point where they are joined by small

branches. The wall of the vein immediately above the point of attachment of each segment of the valve is expanded into a pouch or sinus, which gives to the vessel when injected, or distended with blood a knotted appearance.

The valves are very numerous in the veins of the extremities, especially in the lower limbs, the vessels there having to conduct the blood against the force of gravity.

These valves are absent in the very small veins, also in the *venæ cavæ*, the hepatic vein, portal vein and its branches, the renal, uterine and ovarian veins. A few valves are found in the spermatic veins and one also at the point of junction of the renal vein and inferior cava in both sexes. The cerebral and spinal veins, the veins of the cancellated tissue of bone, the pulmonary veins and the umbilical vein and its branches are also destitute of valves. They are occasionally found few in number, in the *vena azygos* and in the intercostal veins.

Since the veins are not open but valved tubes the arteries are always selected for injection, for fluid will flow readily only in one direction in the veins, viz.: towards the heart, while an injection through an artery will flow in either direction with equal ease. Weiss' recent anatomy gives a list of some 270 odd arteries, whose exact location and branches should be known to the skillful surgeon and anatomist, but the case is different with the practical embalmer. Life is too short to master all these minor details of the anatomy of the human body unless one can give his entire time to it. Nevertheless, the educated funeral director should have a good knowledge of the larger arteries, especially those usually employed for injection. The largest of all of the arteries of the body is

THE AORTA,

which we have already noticed (See page 68) as arising from the left ventricle of the heart in the form of an arch whose ascending portion begins just opposite the third costal cartilage, on the left side, and extends upwards as high as the upper border of the second costal cartilage of the right side, close to the sternum, and is crossed by the pulmonary artery. (See plate VI.)

The horizontal or transverse portion (See fig. 15.) is directed backward and to the left side. The descending portion of the aorta extends to the lower border of the fifth dorsal vertebra, where the *thoracic aorta* is usually said to begin. The thoracic, still descending, retains its name until it reaches the aortic opening in the diaphragm (See fig. 8), giving off branches on either side. Below the diaphragm the aorta is called the *abdominal aorta*, which name it keeps until at the level of the left side of the fourth lumbar vertebra it divides into the two *common iliacs* at a point corresponding nearly to the umbilicus. These common

iliacs are only about two inches in length, for at that distance from their origin each of them again divides into two branches, viz.: the right and left external and internal iliac.

The *internal iliacs* supply the walls and viscera of the pelvis and the inner side of the thigh. Each is about an inch and a half long, and at the

FIGURE 15.

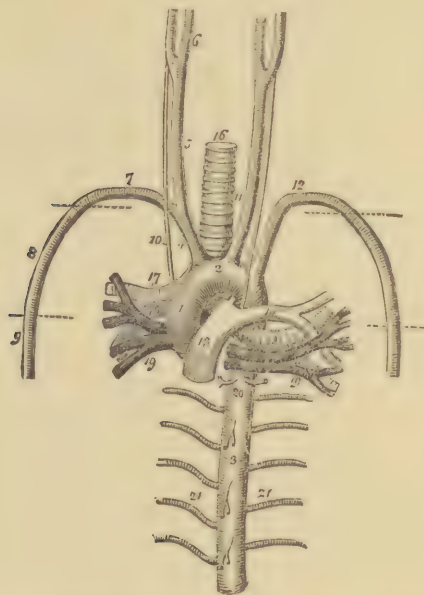


Diagram of the large vessels of the heart and lungs (from Wilson).

- | | |
|------------------------------------|---|
| 1. Ascending aorta. | 13. Pulmonary artery. |
| 2. Transverse portion of the arch. | 14. Left pulmonary artery. |
| 3. Thoracic or descending aorta. | 15. Right pulmonary artery. |
| 4. Arteria innominata. | 16. Trachea. |
| 5. Right common carotid. | 17. Right bronchus. |
| 6. External and internal carotids. | 18. Left bronchus. |
| 7. Right subclavian artery. | 19, 19. Pulmonary veins. |
| 8. Axillary artery. | 20. Bronchial arteries. |
| 9. Brachial artery. | 21, 21. Intercostal arteries; the branches from |
| 10. Right pneumogastric nerve. | the front of the aorta above and below the |
| 11. Left common carotid, | number 3 are pericardiac and cesophageal. |
| 12. Left subclavian artery. | |

upper margin of the sacro-sciatic foramen divides again into two branches, viz.: the anterior and posterior, which are of no especial interest to the embalmer. The *external iliacs*, however, are very important vessels for they are the chief arteries of the lower extremities and, by way of the femoral and popliteal arteries, through these iliacs arterial embalming is most successfully performed. The *femoral artery* is a direct prolongation

of the external iliac, to which this name is given, after it passes below Poupart's ligament until it becomes the popliteal artery still lower. The femoral artery then is all that portion of the external iliac which lies between Poupart's ligament and the opening in the adductor magnus muscle. (See Plate III.) Below the opening in the muscle already referred to the femoral artery takes the name of the popliteal, and, lying convenient of access directly behind the knee joint, is sometimes used for purposes of injection. Below the popliteus muscle, the popliteal artery divides into two smaller arteries—tibial—and its further subdivisions are of no especial interest to the embalmer. (See Modern Embalming for directions to find and open the femoral and popliteal arteries.)

Returning again to the arch of the aorta, whose upward branches we passed by to consider the downward distribution of the thoracic aorta and its branches, we may learn from figure 15 that it gives off from the arch two branches, to which the names of *innominate* and *left common carotid* have been given (4 and 11 Fig. 15). The innominate as may be seen in figure 15 soon divides into the *right subclavian* and the *right common carotid*, while the left subclavian is not a bifurcation with the left common carotid, but is given off separately from the arch of the aorta. The subclavians, as their name denotes, lie behind the collar-bone in their progress to the axilla, or armpit, curving over the fifth rib. After passing between the scaleni muscles, they descend upon the first and second rib into the axilla, where the vessel is now known as the axillary artery (Ax. a. Plate II). It proceeds from the axilla to the bend of the elbow, and during this course, is generally denominated the humeral or brachial artery. (Plate IV.)

Both the axillary and brachial arteries (See Plate IV.) are frequently used for arterial injections by certain embalmers. Full directions for locating and opening these arteries will be found under the head of Modern Embalming, as will also directions for finding the common carotid which, next to the femoral, is most frequently used for this purpose. It will be remembered that the right carotid arises from the innominate just behind the juncture of the collar and breast bone, while the left arises directly from the highest part of the arch of the aorta, consequently the left carotid is longer and more deeply placed in the neck, hence the right is more frequently employed for injections. (See page 44.) With the common carotid we conclude our brief review of the circulatory system of the body and return to speak of the

ABDOMINAL CAVITY,

which is the largest in the body and is, as its name implies, located in the abdomen, and separated from the thorax by the diaphragm, below which it entirely lies. For convenience it is usually divided by

four imaginary lines into nine regions. Two lines are horizontal and parallel, one through the crest of the ilia, another horizontally from one ninth costal cartilage to the other. The vertical lines are drawn from the seventh costal cartilage to the middle part of Poupart's ligament. (See Plate III.) The various organs, viz.: the liver, stomach, spleen, pancreas, intestines, bladder, etc., contained within these boundaries are well shown in the annexed table, taken from Heath, which gives the location where each organ may be found according to the arbitrary division just mentioned.

TABLE OF ABDOMINAL CONTENTS.

<i>1. Right Hypochondriac Region.</i> Right lobe of liver and gall-bladder, first part of duodenum, hepatic flexure of colon, right supra-renal capsule, and part of right kidney.	<i>4. Epigastric Region.</i> Stomach (center and pylorus), left lobe of liver, celiac axis, abdominal aorta, vena cava, semi-lunar ganglia, receptaculum chyl, and vena azygos.	<i>7. Left Hypochondriac Region.</i> Stomach (cardiac end), spleen and tail of pancreas, splenic flexure of colon, left supra-renal capsule, and part of left kidney.
<i>2. Right Lumbar Region.</i> Ascending colon, small intestine, second part of duodenum, head of pancreas, right kidney.	<i>5. Umbilical Region.</i> Great omentum, transverse colon, third portion of duodenum, body of pancreas.	<i>8. Left Lumbar region.</i> Descending colon, small intestine, left kidney.
<i>3. Right Iliac Region.</i> Cecum coli, ureter, spermatic vessels.	<i>6. Hypogastric Region.</i> Small intestines, apex of bladder in distension and in children. Pregnant uterus.	<i>9. Left Iliac Region.</i> Sigmoid colon, ureter, spermatic vessels.

Beginning with the first, or the right hypochondriac region, we find the liver, directly beneath the diaphragm in whose concavity it lies almost entirely protected by the overhanging ribs, past which it extends to the center of the body, or a little beyond. The left lobe of the liver is considerably smaller than the right, and extends still further to the left, partly covering the stomach. The liver, as may be seen in cut 18, is a large, irregularly flattened brownish-red organ, held nearly horizontally in its place by a fold of the peritoneum, and possesses five lobes and five fissures. Its upper surface is convex to accurately fit the concavity of the diaphragm, and its lower surface is thicker behind than before. Through a notch, or fissure on the posterior edge of the liver, the inferior vena cava (*v. c.*), already described, passes on its way to the heart. Near this the portal vein, which as may be seen in cut 18, containing the venous blood coming from the intestines, enters the liver and divides into branches which spread themselves through its substance. In the same fissure there can also be found an artery (the hepatic) coming directly from the aorta. If the branches of this artery and the portal vein are followed into the liver, they will be found to branch and subdi-

vide until they end in capillaries which hold in their meshes what are known as the lobules of the liver. These are not, as might be inferred from the annexed cut, flat disks, but polygonal masses, seated upon

FIGURE 16.

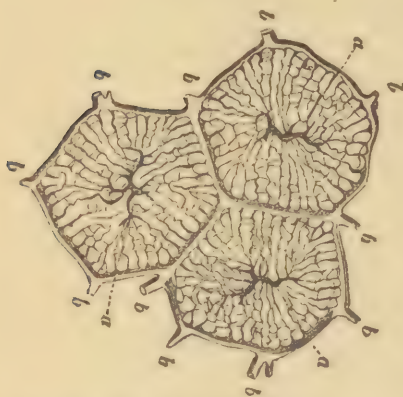


Fig. 16.—Diagram of the circulation in the lobules of the liver (after Kiernan.)

a, a. Intralobular veins. *b, b.* Interlobular veins.

branches of the hepatic vein, into which branches the capillaries of the lobules empty by a minute veinlet, called the intra-lobular (*a, a*), traversing its center. Thus the venous blood of the portal vein and the arterial blood of the hepatic artery reach the surfaces of the lobules by the minute branches of that vein and artery, are mixed together in the capillaries of each lobule, and are thence carried off by its intralobular veinlet which pours its contents into one of the ramifications of the hepatic vein. These ramifications, joining together, form large and larger trunks, which at last reach the rear margin of the liver and open into the vena cava inferior, where

it passes upward in contact with that organ. Thus it comes to pass that the liver is one of the most vascular organs of the body, being freely supplied with both venous and arterial blood, the arterial being brought there by the hepatic artery directly from the aorta, and the venous blood coming from the portal vein which is made up of veins coming from the stomach, pancreas, spleen and intestines. (See Fig. 18.)

From its intimate relation with the aorta, as may be seen from the same plate, the vessels of the liver may be easily reached by arterial injections. Hence when these are properly made, the liver is among the best preserved of the viscera, unless badly diseased before death.

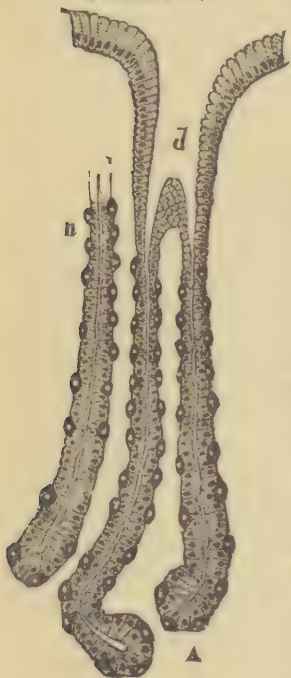
The liver is one of the most vascular organs of the body, and has evidently some function to perform in connection with the blood; exactly how much is done by it for the economy we do not know, except that in the liver the blood is in some manner purified, and that during this process the bile is formed which plays no unimportant part in digestion. (See Chemistry of the Human body.) The bile is secreted by the bile cells which occupy the meshes of the capillaries of the liver, and after being secreted by them drains into the interstices, or bile ducts, as they are called, which communicate with a main biliary duct, down which the bile passes to the intestine, where it helps to digest fat, etc. When digestion is not going on the opening from the biliary duct into the

intestine closes and the bile flows back and fills the gall bladder about the extremity of the cartilage of the tenth rib. (See Plate II, g. b.)

THE STOMACH

lies next to the liver, whose lobes partly cover its lesser curvature or pyloric end, as it is called. (See Plate II and Fig. 18.) Its shape is that of an irregular bag with two openings, viz: the pyloric, which opens into the intestines, and the cardiac, which is the entrance through which the food descending from the mouth passes. The stomach may become so distended as to occupy a large portion of the abdominal cavity, for its size depends upon the habits of its owner. Ordinarily it holds about two quarts, and occupies the left hypochondriac region. It hangs suspended in the abdominal cavity, being held in place by the œsophagus and by attachments to the diaphragm and liver. The stomach

FIGURE 17.



Peptic glands.

A. Under a low power; *d*, duct; *n*, neck; B, part of the fundus of a gland tube under a high power; *p*, parietal cells; *c*, chief cells.

has four coats, and on opening these we find the inner, or mucous membrane, lining the wall of the stomach, lying in folds or rugæ. It is very delicate, and multitudes of small, simple glands open upon its surface. Among these are others which possess a somewhat more complicated structure, their blind ends being subdivided. These are the peptic glands (See Fig. 17.), whose function is, when food passes into the stomach, to throw out a thin acid fluid, called the gastric juice. (See Chemistry of the Body, for it is impossible in the present section to intelligently discuss the subject of digestion further than to say that the purpose of the gastric juice is to render insoluble food possible of solution and subsequent assimilation.)

By continued agitation with the gastric juice the food becomes converted into a fluid about the consistence of pea soup, which is called chyme, and which the pylorus now allows to pass into the intestines without such objection as it makes if the food still remains lumpy. In the duodenum, or upper portion of the intestine, much of this chyme is directly absorbed (See Lacteals), and the remander, still further acted upon by the intestinal fluids, is digested as far as possible and the residue ejected from the body as feces.

After death this partially digested food and fermentable refuse under-

goes putrefaction more rapidly than any other of the contents of the body and being, as it were, in a tube open at both ends, thus gives rise to the formation of gas and purging from mouth and anus so annoying to the funeral director. This can always be remedied by

FIGURE 18.



Branches of the coeliac axis (from Wilson).

- | | |
|------------------------------|------------------------------------|
| 1. Liver. | 18. Pancreatico-duodenalis, in- |
| 2. Its transverse fissure. | osculating with the inferior |
| 3. Gall-bladder. | pancreatico-duodenalis. |
| 4. Stomach. | 19. Division of the hepatic artery |
| 5. Esophagus. | into right and left branches; |
| 6. Pylorus. | the right giving off the cystic |
| 7. Duodenum, descending por- | branch. |
| tion. | 20. Splenic artery, traced by |
| 8. Transverse portion of the | dotted lines behind the |
| duodenum | Stomach to the spleen. |
| 9. Pancreas. | 21. Gastro-epiploica sinistra. |
| 10. Spleen. | 22. Pancreatica magna. |
| 11. Abdominal aorta. | 23. Vasa brevia to the great end |
| 12. Coeliac axis. | of the stomach. |
| 13. Gastric-artery. | 24. Superior mesenteric artery, |
| 14. Hepatic artery. | emerging from between the |
| 15. Its pyloric branch. | pancreas and transverse |
| 16. Gastro-duodenalis. | portion of the duodenum. |
| 17. Gastro-epiploica dextra. | |

emptying the intestinal canal of its gases and filling its cavities with antiseptic fluids to prevent further decomposition, but it is a mistaken idea that you can inject the cavity of the stomach by simply pushing the trocar anywhere into the abdomen and injecting fluid into it. The correct place for the insertion of the hollow needle for this purpose is shown at iv. plate 1. This is often unnecessary.

The gastric artery supplies the stomach with blood in life as it does fluid in after death, and arterial injection through this is generally sufficient to destroy the ordinary amount of gases accumulating there without injecting directly into the cavity

of the stomach and there are other arteries that supply the stomach in addition to the gastric.

THE SPLEEN

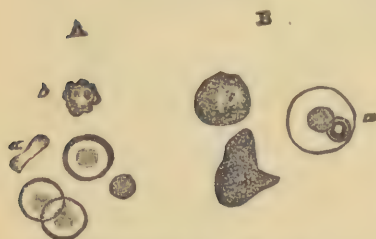
As may be seen by the above cut, lies somewhat below and to the left of the stomach. It lies just below the diaphragm which separates it from the ninth, tenth and eleventh ribs of the left side. See plate II.

It is somewhat oval in shape, concave toward the cardiac end of the stomach which it embraces, and convex and smooth upon its external surface. Its weight is from four to eight ounces, and it is freely supplied with blood vessels amply sufficient to preserve it by means of arterial injection. In fact the organ undoubtedly performs an important part in the manufacture of the red blood corpuscles, and here, perhaps, would be as favorable a point as any to speak of

THE BLOOD.

A single drop of blood beneath the microscope shows that it is not the simple crimson fluid that it appears to the unaided sight, but a colorless fluid in which float a multitude of small bodies, to which the name of blood corpuscles has been given. These are of several kinds,

FIGURE 19.



Corpuscles of human blood.

Magnified about 600 diameters.

A. Red corpuscles: *a*, a corpuscle seen edgewise; *b*, a corpuscle in an altered state, arising from pressure. A small spheroidal red corpuscle, such as may be frequently met with in the blood, is represented beside the larger discoidal ones.

B. Colorless corpuscles: *a*, a colorless corpuscle acted upon by diluted acetic acid, showing its nucleus.

namely, the red and the white corpuscles and what are known as elementary corpuscles, or as the latter are more generally known blood plaques, or blood plates (Bizzozero). These last have only been recently recognized as anything more than granular debris circulating in the blood. Within the last few months, however, they have been accurately described and carefully studied by Prof. Wm. Osler, of Johns Hopkins University. Dr. Osler gives their size as from one-sixth to one-half that of a red corpuscle, which is sufficiently accurate for elements showing such variations in size. Sometimes, however, a plaque may be found which measures as much as 5 mm. It is a circular disc, with a

smooth, well-defined margin, and occasionally some are found which show a bilateral depression. "It is a homogeneous, smooth, structureless protoplasm of a light gray color, and in the unaltered state no nucleus can be found." As to whether a nucleus is found after staining there is considerable dispute. After the blood has been withdrawn from the vessels two peculiarities of the plaques occasion a serious hindrance to their recognition as special elements of the blood, viz.: the rapidity with which the protoplasm alters and their tendency to adhere to one another and to substances with which they come in contact. So long as they are kept in the vessels they do not seem to change more rapidly

than the corpuscles, as Osler has found them unaltered in the pial vessels of man some hours after death; and well preserved plaques may be found inclosed in fibrin taken from the body several hours after death.

FIGURE 20.



Corpuscles of human blood.

From spleen. 1. Blood plaques, colorless and varying a little in size. 2. Microcytes of a deep red color. 3. Two ordinary red corpuscles. 4. A solid translucent, lymphoid cell or free nucleus.

The origin of these blood plaques is still a matter of dispute, for they are variously regarded as young red blood corpuscles, as derived from the red corpuscles; as derived from the white corpuscles; as nuclei floating free in the blood; as fibrin, and finally as independent elements. It seems scarcely worth the while to mention the evidence upon which these views have been founded. Suffice it to say that all these views have been carefully examined by Kemp; and sufficient evidence brought against all of these theories, save those which claim they are hæmato-blasts or young red corpuscles, to render them most improbable.

That they are not due to changes produced in other elements after the blood is drawn is shown by pricking the finger under osmic acid which coagulates all of the other elements of the blood as they leave the blood vessel and still these blood plaques may be shown in the fluid. Furthermore, we could scarcely ask for more conclusive proof than that five competent observers—Bizzozero, Ladovsky, Hlavam, Schimmelbusch and Osler—have seen them circulating in the vessels of the mesentery, and in the uninjured

vessels of the connective tissue of young rats. Kemp's opinion is that there is no doubt that the plaques exist in the blood, and we have not yet sufficient evidence to believe them to be other than an independent morphological element—a view which is held by Max Schultze, Osler, Bizzozero, Laker, Ladovsky, Halla and Schimmelbusch.

But it must be acknowledged that theory of Hayem, that the plaques are hæmato-blasts, is strongly supported. He believes that the red discs are nucleated, and in an article in the "*Archives de Physiologie*" three years ago, he asserted with confidence that the plaques are bi-concave. Laker agrees with Hayem on this point, but Bizzozero and Schimmelbusch assert that they only become bi-concave when drawn into a salt solution, or Hyem's fluid. Kemp, however, asserts that in addition to seeing them on edge and making out their characteristic dumb-bell shape, he has succeeded several times in seeing them roll over in a very slow current, so that at least in osmic acid and Hayem's solution he was able to convince himself beyond all question of their bi-concavity. The bi-concavity is also shown in a photograph made from a specimen stained with Bismarck brown, hence it may be fairly admitted that in all probability these blood plaques are incipient red blood corpuscles, though we have much yet to learn in regard to their place of origin and methods of

development. *The red corpuscles*, although so named are not really red, except in mass, for as seen under the microscope they have only a pale amber, or straw tint. They are flattened circular discs, so small that 32,000 must be laid side by side to measure an inch across, and according to Huxley, 10,000,000 will lie on a space an inch square. The broad faces of the discs are not flat but somewhat concave, and hence their shape has been sometimes compared to a heavy muffin, or one whose top and bottom have been pushed in towards one another. Hence, the corpuscles are thinner in the middle than at the edges and when viewed edge-wise look like short, thick rods. They are soft, flexible bodies, which alter their form according to the fluid in which they are immersed, swelling out when placed in water, or any fluid of less than their own specific gravity, and becoming wrinkled and creased when plunged into glycerine or any dense fluid, and moreover adapt their shape to the caliber of the blood vessel through which they are passing. (Fig. 19.)

In the center of all the red corpuscles there is a dark spot, which is elliptical in shape. These spots or nuclei, when viewed in the light in a particular situation, reflect it, and present the appearance of holes, which at one time induced the belief, that the particles were annular in form. Recent microscopical observers have satisfied themselves of the fact that the dark spot in the center is owing to the presence of a solid nucleus in each particle. These corpuscles give a clear red solution with water and are bleached by dilute muriatic acid, expanded by carbonic acid and flattened by oxygen gas. No less remarkable are the white corpuscles (See figure 19.) which are now generally supposed to be the same as those found in pus, or matter discharging from a wound. Under a microscope these colorless or white corpuscles are seen to be larger than the red (1-2500 inch), and differ also from the red in their irregularity of form which is constantly changing. Careful watching of a colorless corpuscle shows that every part of its surface is undergoing active contraction or dilation, apparently both living and active. When killed by dilute acid they are shown to be spheroidal sacks, or bags with very thin walls, containing fluid and a nucleus. "The red corpuscles" says Huxley "are in some way or another derived from the colorless ones, but the steps in the process have not been made out with certainty. There is very great reason, however, for believing that the red corpuscle is simply the nucleus of the white corpuscle." Probably the third corpuscle of Bizzozzero supplies the intermediate step. But it must be remembered that these corpuscles are not the only part of the blood. They are solid or semi-solid, and the blood is liquid. So there must be a still larger proportion of fluid to make it the bright red liquid so well known to all. This fluid part is known as the liquor sanguinis or *blood serum*, as it is frequently called, although the former is the better name. It is almost

transparent, very lightly tinged with a greenish yellow color ; except when impregnated with a portion of bile, which colors it bright yellow.

It contains a large quantity of albumen, or matter like the white of an egg. If heated to 140 degrees Fahrenheit, it becomes opaque ; and when the heat is increased to 150 or 160 degrees it is firmly coagulated. It is also coagulated by alcohol, by mineral acids, and sometimes by rennet. It is proved by chemists that it contains a small quantity of pure soda, also common salt and soluble phosphates. (See Chemistry of the Human Body.)

In every 100 parts of blood, there are 79 parts of water and 21 of solids, which can be approximately separated by *coagulation*, or clotting of the blood, for the blood of a healthy person shows a tendency to coagulate very soon after it is discharged from the vessels which contain it, although it remains perfectly fluid in them. If allowed to remain at rest, after it is drawn from the vessels, it soon clots into a solid mass of a soft texture. From this solid mass a fluid is soon observed to issue, which appears in small drops on almost every part of the surface. These drops quickly increase and run together, and in a short time the fluid surrounds the solid mass, and exceeds it in quantity.

The solid part which thus appears upon the spontaneous separation of the blood, is denominated "crassamentum" or "cruur." The fluid part is called "serum."

The corpuscles which contain the red color of the blood remain with the "crassamentum." The "serum" when it separates without agitation is free from the red color. The coloring matter may be completely separated from the crassamentum by washing it with water. (See Hæmatin, etc, Chemistry of the Human Body.)

Coagulated blood, therefore, may be divided into three parts, namely: the "serum," the corpuscles and fibrine, the substance which holds them together in the clot.

Fibrine was once supposed to be dissolved in the liquid sanguinis because it can be obtained in fine entangled threads, by whipping fresh blood with small twigs upon which the fibrine will form during the process. Long and careful washing of a blood clot, too, will leave only its fibrine behind, as this is perfectly insoluble after it has once coagulated. In this state it appears to have all the chemical properties of the fibrous matter of muscular flesh. It also resembles the gluten of vegetables, being soft and elastic; the name fibrine is generally applied to it.

If fibrine is washed and dried, its weight is very small indeed when compared with that of the blood from which it has been obtained. It is, also, proven that the spontaneous coagulation of the blood, which appears to depend principally upon fibrine, may be prevented by the addition of various foreign substances to the blood, when it is drawn, so that coagu-

lation of the blood is undoubtedly a physico-chemical reaction which will be discussed more at length under its appropriate section of the chemistry of the body. Here it will be sufficient to note that the formation of fibrine is probably due to the reaction of two substances, globulin and fibrinogen—which see—contained in the blood.

In the majority of dead bodies the blood is found more or less coagulated in the veins, but in some it is found uncoagulated. It is asserted that it does not coagulate where death is the result of drowning, suffocation, lightning, asphyxia, or under other circumstances which will be discussed more at length under the head of putrefaction.

THE LYMPHATICS.

Returning again to the abdominal cavity we shall find it mainly occupied by the intestines, as the convoluted alimentary canal is here named. (See Plate II.) These are usually spoken of as the large and small intestines, the former extending from the anus to the ileo-cæcal valve and the smaller from that point to the pyloric orifice of the stomach. The large intestine is not so called from its length, but from its relative larger caliber. The smaller intestine measures about 20 feet, and in this much of the digestion and absorption of food takes place, for it should be remembered that the body possesses in addition to its system of blood vessels another to which the name absorbent has been given. It is composed of lymphatics and lacteals. The lymphatics are the general absorbents of the body and the lacteals are those whose special function is to take up from the inner coats of the intestines, chyle or properly digested food. (See Chemistry of the Body.) The lacteals and lymphatics are, however, exactly alike in structure and unite to form common trunks which finally empty into the vena cava through the thoracic duct. The fluid circulating through the lymphatics, except in the lacteals already described, is so nearly like water that they derive their name from *lymph* water (Gray). These lymphatics are exceedingly delicate vessels, whose coats are so transparent the fluid they contain can be readily seen through them; they are very widely distributed throughout the body, originating from the surfaces of all its cavities and all other structures, except brain substance, the spinal cord, cartilage, tendons, nails and hairs. They constitute, like the veins, an immense system, and, like the veins, the lymphatics are provided abundantly with valves.

Here the analogy ceases between the two systems of vessels, for the absorbents differ from the veins, in having their courses interrupted from time to time, by lymphatic glands, by the mode in which they run—not uniting successively into branches and into trunks like the veins, but each running as it were an independent course from its origin to near its termination, and not enlarging much in diameter, though

they anastomose frequently with each other. The fluid which circulates in the veins, is yet, though in a diminished degree, under the influence of the heart; the fluid of the absorbent vessels, appears to be exclusively under the influence of the walls of the vessels themselves. The origin of the veins has been clearly shown by the microscope to be from the arteries through the intervention of the capillary vessels; whilst the origin of the absorbents though yet involved in much obscurity, on account of their tenuity, and the transparency of the fluids, which they carry, is believed to be wholly different. The absorbents which originate in the lower extremities and the cavity of the abdomen, unite and form a large trunk called the thoracic duct, which proceeds through the thorax, and terminates in the left subclavian vein at its junction with the internal jugular.

The absorbent vessels are composed of two coats, which are thin, but dense and firm, and also elastic. The coats of the thoracic duct may be separated from each other.

The absorbent vessels also contract, as they have been observed to propel their contents with considerable rapidity, by their own contraction, independent of pressure, or of motion communicated by any other body. Where the different trunks of the absorbents open into the veins, there are one or two valves to prevent the regurgitation of blood into them. The valves of course prevent the injection of these vessels from their trunks. In some animals the valves have sometimes been ruptured, or forced back; and the absorbents have been injected in a retrograde direction, and it is stated by Dr. Soemmering, that when mercury is forced backwards in the absorbent vessels of the foot and the heart, it has sometime escaped from the surface of these parts.

The *lymphatic glands*, sometimes called the conglobate glands, are small solid bodies situated along the track of the lymphatics, which pass through their gland substance. Those located in the neck and groin are best known, for the lymphatic glands of these parts are very prone to enlargement and the formation of abscesses (which see). In size the lymphatic glands vary from that of a small pea to an almond and their color is usually pinkish gray. They are enveloped in a fibrous capsule which penetrates the interior dividing it up into segments not unlike those of an orange. Their function is not yet fully understood, but apparently they act as filters for the lymph which passes slowly through their meshes and probably leaves its foreign bodies behind in the glands. (See lungs page 64.)

The body also possesses another and more important pair of filters known as

THE KIDNEYS.

These lie on either side of the backbone and are supplied with blood!

by the renal arteries, both of which are given off from the abdominal aorta, hence these organs can be thoroughly reached by arterial injection. Their function is to filter away from the blood the sewerage of the body, the urine, which is carried from each by means of a narrow tube called the ureter, which empties into the bladder (Plate II-bl.). Into this the urine dribbles drop by drop until enough accumulates there to produce sufficient distension of the bladder to cause its evacuation. The amount of urine thus voided in a day depends upon the amount of fluids taken, the temperature and the amount of liquid matter passing otherwise from the body, but the average quantity is 24,000 grains, or about three pints. For the composition of urine we refer the reader to the section on the chemistry of the human body, where its discussion properly belongs. Neither have we space to treat of the histology of the kidneys, for so exquisitely are they constructed that it would require several pages to describe their various parts. It should be remembered that the kidneys are not located as low down in the back as is popularly believed. They lie in the back part of the abdominal cavity behind the peritoneum, extending from the eleventh rib to near the crest of the hip bones and are about four inches long and two inches broad. In post mortem examinations they can be most conveniently reached by opening the abdomen, but in surgical operations they are more safely approached from the back as in this way the operator avoids wounding the peritoneum. This

PERITONEUM

is a curious, fibrous sack in whose folds are held most of the abdominal organs. From its proneness to inflammation, opening the peritoneum has always been considered one of the most dangerous of surgical operations, but under proper precautions it has been found that this can now be done with comparative safety, and the organs lying within it are now operated upon with the happiest results. These organs are the liver, stomach, spleen, first portion of the duodenum, and small intestines; the transverse colon, sigmoid flexure, upper part of the rectum, uterus and ovaries, all of which are almost entirely invested by it. The lower part of the rectum, the neck, base, and the whole front of the bladder, as well as most of the vagina, have no peritoneal covering. The folds and convolutions of the peritoneum are so many and complicated that it would be a tedious task to enumerate them, the more so that they have no especial interest to the readers of this work, except that a peritoneal inflammation is almost certainly fatal, and when occurring after childbirth leaves the body more prone to rapid decomposition than almost any other cause of death. For the same reason extra care should be given the body after death from any disease of the

GENITO-URINARY ORGANS.

These comprise the kidneys, ureters, bladder and sexual organs. The

former have been sufficiently described and but brief space can be allotted the remainder. The external genitals are well known as to location and their tendency to early putrefaction, but it is not so generally known that the womb, virgin or impregnated, resists putrefaction to a remarkable degree.—(See Putrefaction).

THE WOMB AND OVARIES,

lie in the pelvic region behind and above the bladder.

Attached to the womb on either side, right and left, are the Fallopian tubes and ovaries in which the ovum, or human egg, is formed and thence passes down a Fallopian tube until it reaches the cavity of the womb with which the tube communicates. Each ovary is about an inch and a half long and a third of an inch thick and in shape is not unlike a large almond. The Fallopian tubes are two in number, one on each side of the uterus and are about four inches in length and contain a canal within them, opening into the uterus not larger than a fine bristle.

These organs give little trouble except in cases of pregnancy, cancer, or ovarian tumors, (which see.) “We have no positive evidence that when we inject the arteries of the subject, the unborn child also receives the injection, hence it is recommended to use the trocar and puncture the womb from the lower part of the abdomen, or at the highest point. It may be well while the trocar is in, and before you inject, to turn the body on its side to allow water if any exists, to pass off, after which inject as much fluid as the womb will hold.”—Renouard.

THE MALE ORGANS.

“The most essential organs in the male system are two glandular bodies called testes which are placed, after birth, outside of the body, in an external envelope, called the scrotum, hanging from the pubic bone. The use of these organs is to produce the male principle or semen, as the ovaries produce the female ova or egg. The testes, like the ovaries, are not capable of performing their proper functions, till a certain period of life called puberty, but unlike them, they are not liable to lose their powers at any particular age, but may preserve them indefinitely. In the early stages of existence in the womb, the testes are contained in the abdomen and only descend to the scrotum just before birth.

On dissecting one of the testicles, it is found to be chiefly composed of blood-vessels, and numerous small tubes containing semen. A branch of the spermatic artery is sent from the abdomen down to each testis, in which it divides and subdivides into thousands of little branches, many of which are too small to be seen by the naked eye. It is this artery that brings to the testes the pure blood from which, probably, the semen is formed. The capillaries of the minute arterial branches are apparently continuous with the commencement of the semi-

nal tubes, so that in examining them we gradually lose sight of the blood and begin to find semen.

The seminal tubes are at first exceedingly minute, but very numerous, and they gradually unite together to form larger branches and trunks, till eventually the whole form but one tube, called the vas deferens, by which the semen is conveyed to the urethra. The number of these little tubes has been estimated at over sixty thousand in one testicle, and it has been shown that if they were put in a straight line, they would measure many hundreds, if not thousands, of feet. There is also a branch of the spermatic vein connected with each testis, which ramifies in its substance similarly to the artery. This vein is to take away impure and refuse blood when no longer needed. The testicles are mainly composed of three kinds of tubes or vessels, namely, arteries, veins, and seminal tubes. In addition to which there are also numerous nerves and lymphatics, or absorbents, the whole being connected together by cellular tissue. Each testis is connected with the body by the spermatic cord, which is a kind of sheath, or tube, about half an inch in diameter containing the main branches of the artery, nerves and lymphatics, going to the testis with the main branch of the vein and the vas deferens, coming from it. This spermatic cord ascends into the abdomen where the different vessels composing it are distributed to their respective places. Each testis is also surrounded by a distinct coat or tunic, beside the scrotum, in which both are inclosed.

The manner in which the semen is actually made is, of course, unknown to us: we can only point out the place where it originates, and explain its progress toward the exterior of the body.

The vas deferens from each testis, into which all its seminal tubes has poured their contents, ascends into the abdomen through the spermatic cord and rises nearly as high as the top of the bladder, behind which it turns and then begins to descend till it meets over its lower part with two small organs called the seminal vesicles, with which it becomes connected. From the seminal vesicles the semen passes down the ejaculatory canal, which is attached to the bladder, and which joins the prostate gland: finally, by means of some curious opening through the prostate gland, the seminal fluid is passed into the urethra, by which the urine escapes from the bladder, and is ejected from the body.

These several parts comprise the male generative system, and in the act of impregnation each one has a special function to perform. The testes secrete the semen, the vas deferens and ejaculatory canal convey it to the urethra, and the penis deposits it in the female organs, while the seminal vesicles and prostate gland either secrete some necessary addition or effect some modification in it.

The vivifying principle secreted by the male testis is a yellowish-

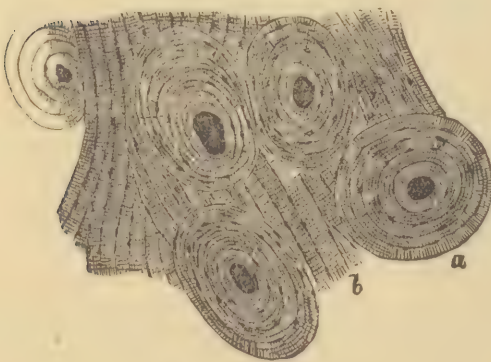
white semi-fluid substance, having a peculiar odor. It is slightly viscid and of a saltish flavor when fresh. On examination it is found to consist of two distinct parts, one nearly fluid and the other like globules of half-dissolved starch, which, however, both melt together when it is exposed some time to the air. The peculiar odor of the semen appears to be derived from some of the parts through which it passes, for, when taken from the testes, it has scarcely any smell at all.

BONES, MUSCLES, ETC.

Having thus briefly taken up in turn the more important organs of the body, there only remains, to complete its description, mention of the packing and wrappings in which the organs are placed. These may be briefly enumerated as bony, cartilaginous, muscular, cellular, adipose and integumentary, including under the latter the hair and nails. *The bony parts* of the body we call its skeleton, a framework made up of 204 separate parts. The bones of an average adult weigh 24 pounds and consist of two kinds of tissue, inorganic and organic, meaning by the first the earthy or more solid part of the bones, and by the latter the gelatinous material found in them. These stand to each other in about the proportion of 66 inorganic to 33 parts of organic material in the hundred, the former of which is practically indestructible for very many years under ordinary circumstances: so much so we are very apt to think that the bones are constructed entirely of these solid parts, but if we examine a fresh bone carefully we shall find it wrapped in a tough fibrous membrane (periosteum) which can only be removed from it with considerable difficulty. If now we examine the bone from which this

periosteum has recently been stripped we shall find on its surface a number of minute reddish points which represent the places where blood-vessels pass from this fibrous covering into the bone substance. Nor do they terminate near the surface, but pass through its entire substance, dividing and subdividing in every direction, as may be seen by the annexed cut. (Fig. 22.)

FIGURE 22.



BONE SUBSTANCE.

This fibrous covering, the cartilage and vessels, compose the thirty-three per cent, or the organic part of the bone, and are so fully protected

from the action of the atmosphere that they are among the last to undergo change, drying down into an elastic gelatinous mass like isinglass. So persistent is this under favorable circumstances that there is a creditable story of a dinner party given by Dean Buckland at which a soup was served made from the gelatin obtained from the bones of fossil animals who had died many hundred years before his day. (See gelatin.) The duties of the bones are both to serve as protection to the soft parts and to act as fulera and levers in doing the body's work. A comprehensive course in physics might be gotten out of an exhaustive study of the shape of the various bones of the body, but this is not the place for it. All that the subject of human osteology can here claim is a reference to the fact that the form of bone depends upon the duties laid upon it, viz.: ivory, or eburnated bone, as it is called, is found wherever strength and support alone are needed, hence we find the shafts of the long bones are of this ivory-like structure, while their extremities are latticed, or cancellated, which kind of bone is found wherever it is desirable to have large surface with as little weight as possible.

Under the microscope, however, there is absolutely no difference in the structure of these two kinds of bones except in the arrangement of their fibres. In the ivory bone they are compressed together and in the spongy bone these bony spiculae, or beams, so cross and interlace one another that this variety of bone is known as latticed, or cancellated bone. For a description of the slight chemical differences between *cartilage* and *bone* the reader is referred to the section on the chemistry of the body; here it is sufficient to remind him that cartilage constitutes what is familiarly known as the gristle of the body and that it only needs the deposition of earthy salts within it to convert it into true bone.

The *muscular system* is made up of about twice as many muscles as there are bones, and by a muscle is understood a mass of flesh which has the property, voluntarily or involuntarily, of contraction or shortening itself, so as to bring its two ends nearer together. This it does by shortening in length each of the fibres of which it is composed, for muscle under the microscope is a highly complex substance composed of sheath, fibres, sarcolemma, nerves, vessels, perimysium and ultimate disks. The preservation of the sixty-eight pounds of muscle in a human body is no unimportant part of the embalmer's care. Under the proper surroundings muscles may dry down into a hard mass like the jerked beef of the Western hunters, but ordinarily muscle breaks up into several simpler compounds which are too numerous to mention, for human flesh is an exceedingly complex substance whose chemistry will be discussed later. Rigor mortis (see page 97) is the first of the marks of decomposition in a voluntary muscle and is due to the coagulation of a semi-fluid substance by which the muscular disks are bathed during life. The muscu-

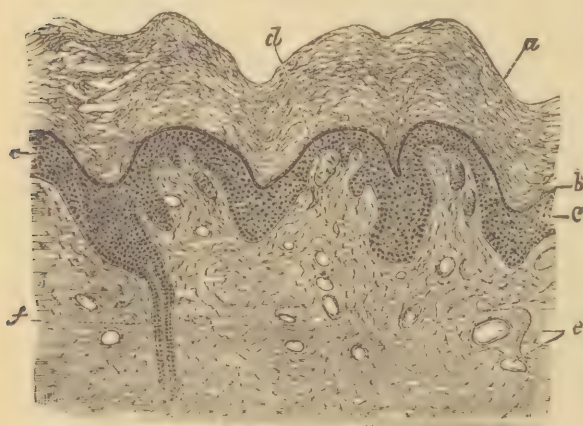
lar disks, just referred to, are the minute bodies of which each muscular fibre is composed by their being laid one above another like a pile of checkers. Each one of these disks has a contractile power and this contractile power of each disk is what enables the muscle as a whole to contract and to perform its work, either by its own contractions as in the heart, or by moving the bony levers of the body.

The muscular disks and fibers are all wrapped in delicate membranes, the muscles in denser ones, and finally all the organs of the body are held together by what is well called *connective tissue*, for it connects or binds the body together as a whole. It is so generally distributed throughout the body that if all else could be taken away—the connective tissue only left behind—there would still remain an exact cast or form of the body, ghost like in its tenuity. Closely examined, connective tissue will be found to consist of thin fibrous sheets, which are capable of being broken up into innumerable fine filaments, which, under proper treatment, will show nuclei. (For chemistry see section on Chemistry of the Human Body.) Ligaments, tendons and what are known as fibrous bands are all modifications of this same connective tissue which is the most widely diffused of any in the body.

Adipose, or Fatty Tissue, differs from connective tissue only in that it contains fat deposited in its areolæ, or interstices. Fat is very widely distributed through

the body, but its quantity depends largely upon the state of nutrition of the person, for fat is simply reserve nutriment to be drawn upon in case of need. No amount of starvation can, however, completely remove all fat from the body, for no matter how emaciated, fat can always be found back of the eye and about the kidneys and heart.

FIGURE 23.



Anatomy of the Skin.

a. The epidermis. b. Two of the quadrangular papillary clumps composed of minute conical papillæ, such as are seen in the palm of the hand or the sole of the foot. c. Deep layer of the derma, the corium. f. Adipose cells.

Its composition and digestion will be further discussed in the section on the Chemistry of the Human Body.

The integument, is the outer covering of the body. On the surface of the body it is known as the skin and inside of the body, we call it mucous membrane, but under the microscope they are almost identical, except in the amount of moisture they contain. The previous cut well shows the structure of the skin of one of the fingers, the elevations representing the minute ridges that may be seen on the finger tips with the naked eye. These contain the blood vessels and nerve terminations which, if exposed to the air would be a source of incessant suffering, so as may be seen from the cut they are covered with a thin brany layer to which the name of epidermis has been given. Its outer layer is dry and scaly and is being continually removed by friction and washing. Its lower layers consist of moist cells, some of which contain the pigment of the skin and through which the hair and sweat glands penetrate to the corium or true skin beneath. This true skin may be removed entire from the human body, as from the lower animals, and may be tanned like their hides. (See tanning.) In fact human skin makes a very fine leather, as was proven in a recent notorious trial in Massachusetts, and all of the earlier methods of preserving the body relied largely upon this tanning of the skin by means of vegetable astringents. Modern chemistry has discovered more efficient agents which are no longer applied externally only, but internally as well through the blood vessels, but before discussing how this may best be done it would be well to consider

B. THE PROOFS OF DEATH.

As it is absolutely essential that a body should be dead before it requires the art of the embalmer, it is equally necessary that he be able to decide beyond all reasonable doubt whether a body presents the proper proofs of death before inflicting such further injuries upon it that a return to life would be impossible. One such mistake would forever blast a professional reputation, hence "whenever there is the least uncertainty, and in all sudden cases, where putrefaction does not commence as suddenly, nothing at least ought to be done that may cause actual death, and the interment should be postponed until the third day, for by the third day changes always appear on the body, which are decisive." In all doubtful cases proceedings should be arrested until these decisive changes make their appearance, though a week should elapse. In all cases of apparent death, particularly from external violence, the body should be treated with the greatest care, for if it is treated as the dead generally are, viz.: laid out on a board in a cold room, perhaps covered with ice, it will certainly be dead very soon if it is not so before. Most emphatically would we say make no attempt to embalm

the body by making any injection of embalming fluid until death is beyond doubt a reality."

There is not a day that passes by that some one does not die suddenly; many of these deaths are called heart disease, and the body is immediately prepared for burial. Such a course is inexcusable for it is possible that the so-called "heart disease" is merely one of suspended animation. A remarkable case of this kind, lasting twelve days, is related by Dr. Lukens in a recent number of the *Casket* (Feb. '86), which we quote in his own words:

"The physician in charge seeing the body immediately after supposed death had ensued, was impressed by a peculiar appearance of the features that possibly there was only suspended animation, and insisted upon keeping the body until dissolution became apparent. The body became cold and rigid; and all means for resuscitation proving fruitless, the body was closely watched and no signs of life were manifest. Day after day passed, the friends became discouraged and the neighbors only insisted that they were keeping a dead body in the house and it ought to and must be buried. The doctor plead with the friends to let the body alone and gained his point. Constant watch was continued, and on the twelfth day the servant saw the "corpse" turn her head to one side, but still apparently unconscious. After a time the head was turned to the other side and after a time life was fully asserted by a living, moving being who entirely recovered from her sickness and became a well woman. While lying in that state she was wholly conscious of all that was being done. During the time of 'suspension' the doctor applied electricity which was the means of causing her to suffer pain and which continued until after she revived."

In all of these cases it would be much safer for the undertaker to wait until some of the positive signs of death are manifest before proceeding to embalm the body or in any way to treat it roughly. It should also be kept in a temperature suitable to one living. We believe that every person whose business is to lay out and take care of the dead should be thoroughly familiar with the death signs, and should make no attempt to operate upon, or apply any of the embalming compounds to, or place the body in an unfavorable temperature until he has evidence beyond a doubt that death is real. It is as much the duty of an undertaker, as of the physician in this rapidly progressive day of his profession, to be intelligently posted on *all* the signs of death for no one of them *alone*, except, perhaps, general putrefaction, is sufficient proof of death. So generally has this been accepted as a scientific fact, that one of the largest prizes of the French Academy (\$4,000) has been offered "for the discovery of a simple and popular mode of recognizing the signs of real death in a certain and indubitable manner; a method which may be put into prac-

tice by poor, uneducated villagers." This prize has not yet been awarded. The following are the signs of death taken mainly from Dr. Tidy's recent work on Forensic Medicine, pages 35-44.

I. *Cessation of the heart's action*, not for a few seconds only but continuously. Mere absence of the pulse at the wrists, or even in other arteries, is not enough, as this may be found in cholera, abdominal collapse, and other kinds of shock, etc. Careful auscultation and palpitation of the cardiac region, in a quiet room, can alone decide the question of cardiac action. In doubtful cases it would be better to employ acupuncture of the left ventricle, and the stimulus of a galvanic shock to the cardiac region. It is well known that two sounds are caused by the heart's working, which have been compared to lub-dup-p, lub-dup-p, etc., but in cases of great weakness, only the second sound may be audible—a blowing sound (bruit) possibly replacing one or both of these in cases of valvular disease of the heart, or great anæmia (poverty of blood). Dr. G. W. Balfour has pointed out that fine needles with little cork or paper flags placed over the heart will often render cardiac movements visible where not previously so. Or the same test may be applied by a bit of hot sealing wax dropped on the chest and drawn out to a fine point as it cools.

It is doubtful, however, if this be available in cases such as we are describing. It should be remembered that there is a "pulse" wherever an artery is superficial enough to communicate its stroke to the exploring finger, as in the facial, the carotids of the neck, the brachial, ulnar, femoral, popliteal, and anterior and posterior tibial arteries. Negative evidence from stethoscopic examinations of the heart, great vessels or lungs, can only be considered decisive when done some hours after the supposed death. There are many instances on record of recovery of infants and young children after the heart had apparently ceased to beat for at least a quarter of an hour. Further proof of arrest of circulation may be obtained by:

1. Ligation of the finger: if it swells beyond or on the distal side of the constriction, then circulation is taking place and the person is, of course, alive.

2. The unaltered brightness of a needle thrust into the body and allowed to remain; and, lastly, no spurting of blood when a cut is made into an artery. The heart may beat so feebly that no pulsation can be felt over the arteries, and the sounds may be so feeble that they cannot be heard. The circulation may be confined to the vital organs, and a needle thrust into a leg or arm would remain bright, because there is no circulation there; but the absence of spurting blood is positive evidence of cessation of circulation, especially when one of the larger arteries is opened. It often occurs that the pulse at the wrist cannot be

felt if the limb be extended or everted; but if it be bent, and the hand turned inward, it becomes perceptible. We should, therefore, perform this movement by which the artery is relaxed. In syncope the beats of the heart can almost always be heard by an experienced auscultator in a quiet room. Dr. Taylor recommends half an hour to be spent in auscultation. It would surely be better to auscultate at intervals of half an hour or more. The heart, and particularly its right half, seems to have life of its own, distinct from the great nervous centers, and continues to beat or contract, even when cut into fragments, for some minutes after its removal from the body. The presumption of death, when this last part of the body no longer gives signs of life, must, therefore, be very strong. The case of Col. Townsend, who could voluntarily suspend the action of his heart for a short time, should not be forgotten here.

II. *Entire Cessation of Respiration.*—The act of breathing is so eminently a vital one, that any long suspension of this function (See Drowning,) cannot but be fatal. Here again the stethoscope should be used, as careful auscultation is far more likely to detect the sounds caused by air, or air and mucus, or other fluids traversing the air-tubes, than any other means. The popular, or domestic, proof of the absence of breathing consists in holding a mirror before the mouth of the person. If this becomes coated with moisture, it is supposed to indicate the presence of life; if the mirror is unchanged, it proves death. This test is fallacious, and the proof of this easy. Any bright or smooth surface will condense the moisture in the air, or breath of a person, if it is cooler than the air or breath itself. Therefore, if the mirror held before a person's face is warmer than his breath, no film will gather upon the glass. Hence the use of a looking glass, to condense the moisture of the breath, or of a feather or other light body, to indicate the movements of the air, although popular, are not very satisfactory methods of ascertaining the continuance, or otherwise, of respiration. There is a peculiar mode of breathing known by the name of "Stokes-Cheyne respiration," sometimes seen in cardiac and cerebral disease, rarely in fevers, in tubercular affections, and perhaps other maladies, which may deceive an incautious observer. The patient, in such cases, breathes at first so slightly as scarcely to seem to breathe at all, each succeeding inspiration is a little deeper until a maximum is reached, and then each breath that follows becomes shallower and shallower, till again the patient may again appear not to breathe at all—then a feeble inspiration is taken, followed by another a little stronger, indicating the commencement of a new series like the former.

III. *Changes in and about the Eye.*—These consist of (1) an entire loss of sensibility to light. The pupil no longer dilates with

a solution of atropine dropped into it, as it does in life, nor does it contract nor dilate according to the amount of light thrown upon it. The best mode of applying this test is known to ophthalmic surgeons as "oblique illumination." A bright light is placed on one side of the eye to be examined, and its rays brought to a focus by means of a double convex lens of about two inches focus, and the lens and light so disposed that this focus falls upon, or nearly coincides with, the pupillary aperture. When no change is produced, the iris remaining immovable, we may then usually conclude that life is extinct. Adhesions of long standing, belladonna or its alkaloid atropine and calabar bean may, however, greatly affect the mobility of the iris, as is well known. Alcohol and some other poisons also produce similar effects. (2.) There is an entire loss of sensibility to touch in the ocular conjunctiva. This is, however, equally true of a period in epileptic fits, and in some cerebral injuries. (3.) The conjunctiva covering the sclerotic soon begins to show a gray cloudy discoloration on its external portion, which later becomes blackish. This is quickly followed by a similar stain on the inner side. M. Larcher, who first pointed this out, considers the phenomena to be due to cadaveric imbibition, and probably dependent upon putrefactive changes. "These two spots extend and approach each other, forming the segment of an ellipse." (4.) The cornea speedily loses its transparency, in other words the eye has lost its luster. This may, however, take place during life, as is repeatedly seen in cholera, and other diseases. (5.) The eye soon becomes sunken in its socket, and the globe itself becomes flaccid, so as to retain the dim or mark of any pressure made upon it. This loss of transparency and so-called film over the eye after death is due to an absence of circulation in its tissues, and varies according to circumstances, for the eye retains its brightness much longer in strong subjects than in old, weak persons, especially when death has resulted from apoplexy, suffocation, prussic and other acids. It has been observed that in severe diseases of long duration, and in some affections of the mind, that the eyes become dim and shrunken before death, and thus another source of fallacy arises.

The opening of the eyes after death is due to the post-mortem shrinking of the ball of the eye, which allows the lids to open. This loss of tenacity, or minus tension, is, however, met with in some diseases of the eye. (6) Supposing the cornea to be clear enough to allow of ophthalmoscopic examination, it is stated by M. Poncet that the yellow-red of the living fundus of the eye is changed at the moment of death to a yellowish-red, or paler hue. M. Bouchut states that beads of air or gas, in other words an interrupted column of blood, will be seen in the retinal veins resembling bubbles of air in the colored fluid of a spirit thermome-

ter, or the beaded appearance familiar to us in nerve tubes. (Pneumato-
osis of retinal veins.) (7) At the same time the eyelids will have lost
their elasticity, neither they nor the globe of the eye moving any longer.
(8) It is said that atropine and calabar bean no longer produce the dilata-
tion and contraction which are their respective property. This is quite
true of a body dead some days, but not always true of one dead only a
few hours. (9) Electric and mechanical stimuli equally fail to affect the
eye of one dead some time.

IV. *Changes in the Temperature of the Body.*—Gradual cooling
or loss of heat is the most common change after death. In some
diseases, however, the temperature of the body actually rises after
death. This is particularly the case after yellow fever (as pointed
out by Dr. Bennett Dowler), cholera, rheumatic fever, tetanus, and
other injuries to the nervous system, small-pox, and some abdominal
diseases, where a rise amounting to 9 degrees F. (or 5 degrees C.) has
been noted after death. It is probable (as the blood is no longer cooled
in the lungs) that there is a slight post-mortem elevation of internal
temperature in all cases of death. Be this as it may, it is a familiar ob-
servation that within a few hours after death the body cools, more or less
rapidly according to the external temperature, the amount of clothing,
and other accidental circumstances. In the case of Gardner, charged
with the murder of his wife, and convicted in October, 1862, the medical
man first called in, stated that she must have been dead at least four
hours, as the body lying on a wooden floor, covered with only a flannel
petticoat and a chemise, was quite cold and rigid. She had lost a large
quantity of blood from a wound in the throat. This led to a number
of observations on the temperature of dead bodies by Drs. Wilks and A.
S. Taylor, who give the following table of the temperature of the body:

	Hours after death.			
	2 to 3.	4 to 6.	6 to 8.	12 or more.
Maximum temperature.....	94°	86°	80°	79° (26.1° C.)
Minimum "	60°	62°	60°	56° (13.3° C.)
Average "	77°	74°	70°	69° (20.5° C.)

These observations were made by simply placing the bulb of a ther-
mometer on the skin of the abdomen. They found internal temperature
of 76 degrees F. seventeen and eighteen hours after death, and of 85
degrees F. ten hours after death. Very numerous observations have been
made on the subject by Messrs. Durand and Linas. The results of their
experiments seems to be that from eighteen to twenty-four hours are
required for the body, under ordinary circumstances, to cool down to the
temperature of the surrounding atmosphere. In summer in hot days a
temperature of 25 degrees C. (77 degrees F.) is not uncommon, whilst an
instance is recorded of a frozen woman restored to life by warmth whose

temperature was only 20 degrees C. (68 degrees F.) M. Laborde has stated that in five or eight hours the temperature of the deeper tissues in the dead body falls to 27 degrees or 28 degrees C. (80.6 to 82.4 F.) But Dr. F. Niderkorn ("De la Rigidite cadaverique chez l'homme," Paris, 1872.) shows that in six cases, taken indifferently six to eight hours after death, the rectal temperature averaged 32.6 degrees C. (90.6 degrees F.), and nine cases, in twelve to fourteen hours after death, gave a rectal temperature of 31.8 degrees C. (89.2 degrees F.) As these observations have not been published in English, we subjoin a summary of his observations, which are taken seriatim from 135 persons dying of various diseases. They differ from those of Drs. Wilks and Taylor by being taken in the axilla and at Paris :

	Hours after death.—			
	2 to 4.	4 to 6.	6 to 8.	8 to 12.*
Maximum temperature.....	100.4°	98.2°	95.3°	100.4° F.
Minimum temperature.....	89.6°	80.6°	70.5°	62.6° F.
Average temperature.....	96.9°	90.2°	81.7°	77.9° F.

The following seem the chief practical conclusions from these and other facts collected on this subject:

1. That even in winter the human body generally takes several hours, certainly not less than four, and sometimes even twelve and even more (Nysten says, "three days in case of asphyxia") to cool down to the temperature of the surrounding air, especially if *internal* temperature be observed.

2. The *external temperature*, the *amount and kind of clothing*, and the *position of the body* all modify the rate of cooling. This cooling seems to depend upon (1) The cessation of heat production by vital or chemical processes; (2) Radiation; (3) Conduction and convection of cool air, cold ground, stones, wood, articles of bedding, and other substances upon which the body rests, or by which it is surrounded.

3. *Age and sex* appear to modify this but little, if at all, *per se*, although the new-born *foetus* probably cools more rapidly than older infants. Fat is a non-conductor of heat and prevents rapid radiation from the body. An emaciated body will become cool much quicker than a body well covered with fat. It will take an average of twenty-four hours for a body to become cool.

4. The *mode of death* has far more to do with it. Large losses of blood are said, by Dr. B. Ward Richardson, to cause rapid cooling. This agrees with our own, and with common experience, but Dr. Taylor has shown that it is not invariably true. A man, aged forty-eight, died from

* Bodies dying from apoplexy, sun-stroke, suffocation (especially by noxious gases), and fevers, retain animal heat much longer than other modes of death. The temperature of a body will rarely ever fall below that of the room in which it remains. Therefore in winter bodies cool much quicker than in summer.

losing about four pounds of blood. Four hours after death the skin of his abdomen had a temperature of 84 degrees F., eight hours of 80 degrees F., although the dead-house temperature was 38 degrees F. only. The conditions were favorable to rapid cooling. It is, however, noteworthy that he had met with an *accident*, necessitating ligation of his axillary artery.

Observations of temperature should be taken by a thermometer and repeated at intervals of a few hours. It is the *progressive, continuous cooling, not the absolute temperature, which indicate death.*

V. *The limbs and joints of the body become stiff. In other words, post-mortem rigidity sets in at a variable time after death.* This rigidity or stiffness is a phenomenon belonging to the voluntary muscles, and although much attention has been given to it, it is a subject still involved in much obscurity. It does not seem certain as yet that it is due alone to coagulation of the *myosin* or albuminous principles of muscular tissues. This body is obtained with difficulty in an uncoagulated state, from warm-blooded animals, and has an extraordinary tendency to coagulate at all temperatures above 32 degrees F. (0 degrees C.) The following facts on muscular rigidity appear well authenticated:

1. The coagulation of the muscle plasma is greatly accelerated by heat. At 40 degrees C. (104 degrees F.) it coagulates almost instantaneously. Cold water and fifteen per cent solution of sodium chloride coagulate it when dropped into them. In ten per cent acid solution it coagulates, but the clot is dissolved, and *syntonin* formed.

2. Living muscles at rest have a double, or amphichromatic reaction on litmus-papers, changing the color of both blue and red. But the red is altered most, so that the muscular reaction may be described as *alkaline*.

3. After *contraction* of a muscle in life, and during post-mortem rigidity, the reaction of the muscle is *acid* (reddens blue litmus-paper). This is particularly evident in rigor mortis.

4. The acid rigid muscle, after death, again becomes soft, non-elastic, and alkaline, as soon as the post-mortem rigidity has passed off.

5. *The muscle in a state of rigor mortis has become opaque.* (See No. 5, under the minor signs of death, also Chemistry of Human Body, for Chemistry of Rigor Mortis and order of occurrence.)

As a rule it begins within six hours after death and lasts for twenty or thirty hours, though it may last for days or even three weeks in cold weather.

Below 28 degrees—11 degrees C., muscular fibers pass rapidly into some new molecular conditions from which they do not return into active life by any known means of recovery (Dr. B. W. Richardson). Brown-Sequard has shown that a current of arterial blood restores muscular contractility to rigid limbs.

Rigor mortis in children begins almost as soon as death takes place, and frequently last only a few hours. In strong, athletic persons it lasts much longer than in emaciated ones. Rigor mortis is a peculiar rigidity of the muscles holding a limb in a fixed position. It can be overcome by sufficient force; and by frequently bending and straightening a limb all its rigidity will be lost. It commences first in the muscles of the lower jaw, neck and trunk, and then extends to the limbs, finally reaching the hands and feet, and in subsiding it follows the same order. Death by electricity is not followed by rigor mortis. Catalepsy is a peculiar nervous disease in which a patient sometimes has all the appearance of one dead, even to the rigidity. As long as rigor mortis lasts you need have no fear of putrefaction, as soon as this takes place the rigidity leaves and the body is limp. Flexibility of the limbs succeeding rigor mortis is one of the most characteristic signs of death.

VI. *Several minor phenomena, or so-called "tests" for death, have been observed, and may conveniently be grouped here—*(1) Loss of elasticity of the skin. The skin when pinched up in a young or healthy person quickly returns to its natural form. The skin of a dead person has lost its elasticity and will remain in folds when it is pinched after the body has cooled. The fallacies of this test are these:—The skin of the aged loses to a great degree its elasticity, and in certain cancerous and other malignant diseases the skin loses it partly or entirely.

2. If scarificators and cupping-glasses be applied to any part, *e. g.*, the pit of the stomach, blood usually flows, but it will not do so after death, at all events not many hours, or apply the flame of a candle to the point of the finger, and if a blister follows, the person is alive; if it becomes parched and brown, then he is dead; unless this test is applied immediately after death, for a burning match, hot scalding wax, cantharides, or blistering fluids, will produce vesication in young and healthy subjects shortly after death, but no longer than the second or third day. (M. Levasseur.)

3. Bright steel needles inserted in any part of the skin will be found free from rust even after some hours. (M. Laborde.) This appears greatly dependent on the amount of cooling and moisture, and is untrustworthy.

4. Wires attached to these needles no longer deflect a galvanometer; nor do they produce increase of temperature when muscles contract by the electrical current. In the living, when a muscle contracts the temperature of the skin is raised, as indicated by a delicate thermometer placed over it.

5. The fingers and hands, especially in young subjects, are translucent during life, but become opaque after death. In other words, if a bright light be placed behind the hand of a living person, in a dark room, it shows a pinkish-red, almost transparent appearance.

6. Dr. Lesenne, of Amiens, says that one can determine with certainty whether a person is dead or not by thrusting a pin into the skin. In a cadaver the hole made by the pin will remain patent, just as if the pin had been stuck into a piece of leather, but if the person be alive the hole will immediately close, leaving scarcely a sign to show where the pin had entered the skin.

7. It has been proposed to inject liquor ammoniæ subcutaneously. In the living body, or in one only just dead, a sort of port-wine congestion is immediately produced. In a body recently dead, a less degree of this might be visible; but in one dead some hours, or days, scarcely any change is produced. This ammonia test is only another proof of the coagulability of the blood. The blood drawn from a living person will coagulate (clot); blood drawn from a dead person will not coagulate and the coloring matter will gravitate immediately after death to the lower portions of the body. Should the body lie upon its back, upon examination it will be found that the lower portions will be of a very dark color, which by many has been taken as the advanced stages of putrefaction, but is simply hypostasis. Should this occur in the face of a corpse it can be removed by using strong bleaching solutions, such as saltpetre, chloral hydrate, chloride of zinc, carbolic acid, and in less severe cases strong vinegar has been used with good results, but the best means where opportunity is afforded to remove such discolorations, is to open both the internal and external jugular veins on each side of the neck and then place a cloth on the face and rub downward until the color has disappeared. This often can be done without opening the veins. When a solution is used to bleach a corpse it should be used by saturating sheet cotton batting and covering the parts closely so as to exclude the air, care being taken not to let the solution remain too long on the face lest it should become too white.

VII. *Putrefaction* is really the only proof that taken alone is positive. It begins over the abdomen and is indicated by a greenish discoloration of the skin, afterwards extending over the entire body and is soon evidenced by what is known as the "cadaveric smell," or the peculiar odor of death, for a dead body has an indescribable odor peculiar to itself, which once recognized is never forgotten. The order and chemistry of putrefaction will be fully discussed under the head of Chemistry of the Body, which see. Whenever the peculiar discoloration of putrefaction and characteristic odor of decomposition appear, there need be no further fear of a premature burial.

APPARENT DEATH AND PREMATURE BURIAL

are not unfrequently predicated upon change of position of the corpse in the coffin, produced by gases arising from decomposition. Such contor-

tions by no means imply that the life has returned to the body after burial, and such cases in my opinion are extremely rare. Nevertheless they do occasionally, for suspended animation has been mistaken for death, especially by the ignorant.

These cases of apparent death are usually those of so-called sudden death, and without the "death agony." They closely resemble the hypnotic or mesmeric condition and are undoubtedly due to a suspension of functions of the cerebro-spinal nervous system and a carrying on of life by the sympathetic alone. (See page —). In these cases sensation is completely preserved, but all power of voluntary motion is lost, a condition of affairs that it is said can be voluntarily entered into by certain of the East Indian fakirs. Paulet reports the following:

"A Hindoo devotee was buried, under the direct superintendence of a British officer, in a grave lined with masonry covered with large slabs and strictly watched. When disinterred three days after, the body was corpse-like, and no pulsation could be detected, at the heart or in the arteries, but it was restored by warmth and friction."

Remembering the possibility of such cases it is always prudent whenever there is the least uncertainty, and in all cases of sudden death, nothing should be done that might cause death until actual proof of putrefaction appears. Such proof would be the odor of death, frothing at the mouth, hypostatic discoloration and the changes about the eye previously described. Hence the great importance of a thorough knowledge on the part of the funeral director as to what is satisfactory proof of death. To facilitate this we add in tabular form all the evidences of death, known to be reliable at the present time.

RECAPITULATION.

The proofs of death then are:—

- I. *Cessation of heart's action* and arrest of circulation of the blood as proven by:
 - (a) Absence of heart's sounds,
 - (b) Failure of heart to contract under galvanic current,
 - (c) No response from acupuncture,
 - (d) No swelling from ligature,
 - (e) Absence of spurting from a cut artery.
- II. *Cessation of Respiration* proven by:—
 - (a) Absence of respiratory sounds,
 - (b) Undimmed mirror,
 - (c) Motionless feather.
- III. *Changes in Eye* which becomes
 - (a) Irresponsive to atropine and light,
 - (b) Without sensibility to touch or electric current,

- (c) Clouded in conjunctiva and cornea,
- (d) Shrunken and loses its transparency,
- (e) Fundus paler by ophthalmoscope, also pneumatosis,
- (f) Eyelids no longer elastic.

IV. *Progressive cooling of the body.*

V. *Rigor mortis.*

VI. *Minor proofs of death.*

- (a) Loss of elasticity of the skin tissues,
- (b) Non-vesication,
- (c) Needle untarnished when inserted into body,
- (d) No increase in temperature by muscle contractions,
- (e) Opacity of fingers,
- (f) Injection of ammonia,
- (g) Failure of blood to coagulate,

VII. *Putrefaction.*

METHOD OF MAKING A POST-MORTEM EXAMINATION.

Time Required 2 to 3 Hours.

While it is not usually the duty of the attending undertaker to personally conduct an autopsy, circumstances may arise where it is clearly his duty to do so : and to provide for such emergencies, the following section is added in the hope that it may be of service. For while it by no means attempts, by its perusal, to transform the reader into a pathologist, it may reasonably purpose to furnish such general directions for making an autopsy as will enable one fairly posted in regard to the location of the more important organs of the body, to make an intelligible report and such a one, as in the absence of the proper medical officer, may remove unjust suspicion of murder or suicide. A complete examination in any case of sudden death from unknown causes should embody all of the following points which have been re-arranged from Virchow's recent work on Post-Mortem Examinations.

I. *External Appearance*, under this head should be noted :

1. Apparent age.
2. Height.
3. Build, muscles, fat.
4. Color of body, noting especially that of abdomen, flanks, scrotum, and genitals.
5. Hypostases and ecchymoses.
6. Fluids escaping from the body, and whence.
7. Hair and ears.
8. Hands.
9. Joints and their mobility.
10. Face, eyelids, nostrils and lips.

11. Neck and thorax.
12. Abdomen and genitals.
13. Back and anus.
14. Wounds, if any, and where located.

II. *Cranial Cavity.* To open this the soft parts over the skull should be divided by an incision carried transversely over the head and the flaps reflected back, noting carefully the color of the same while so doing, as well as that of the skull itself. The skull should next be sawn through horizontally with the membranes of the brain which are removed with the upper half of the skull. Note excess of serum, also fluid in sinuses and effusions, if any; condition of arteries at base of brain and dura mater after stripping it from skull. The bones should be carefully examined for possible fractures and the general appearance of the surface of the brain noted. The lateral ventricles may be explored for information as to the amount of fluid they contain, but further explorations of the brain substance is rarely of any real value except in the hands of an expert pathologist.

III. *Cavities of the body.* To properly examine these a long incision is made extending from the chin to the pubic bones and the integument and muscles pulled back, noting at the same time the amount of fat and the color of the muscles. On opening the abdominal cavity examine while parts are in place for:

1. The presence of any foreign body.
2. The position of the arch of the diaphragm.
3. Color and position of the abdominal viscera.
4. Distension of the intestines with gas or fluids.
5. Omentum and peritoneum.

IV. *The Thorax* should be carefully inspected after having removed the sternum by cutting it away from its attachments to the ribs through the costal cartilages. Then in order note:

1. Color of lungs, pleura and pericardium.
2. Fluid, if any in pleura or pericardium.
3. Adhesions, if any, and where found.
4. Heart, size, fat, color and amount of blood contained.
5. Condition of the valves of the heart.
6. Distension, if any, of the veins of the neck.

V. *Mouth and Windpipe.*—The first should be examined as already directed, by opening the buccal cavity from below, the tongue drawn aside, and the upper part of the throat exposed. Note:

1. Amount of froth, mucus or blood in the cavities.
2. Appearance of the tongue.
3. Size and color of the tonsils.
4. Interior of the windpipe, color, swelling, etc.

VI. A complete autopsy would now require that the lungs, œsophagus, great vessels, stomach, liver, spleen, kidneys and bladder should be removed and examined separately, but unless this is done by an expert the examination is of comparatively little value. Hence it is far better in such cases as this section is designed to provide for, to carefully remove these organs and preserve them, either in part or entire, in clean new fruit jars and sealed, until such time as they can be examined by one competent to make such an examination. Taylor recommends that a little chloroform be added before sealing, to assist in the preservation of the viscera, especially where it is desired to make an examination of them afterwards for poison.

PLATE III.

Figure I. Dissection of upper leg and landmarks for injection through the femoral artery:

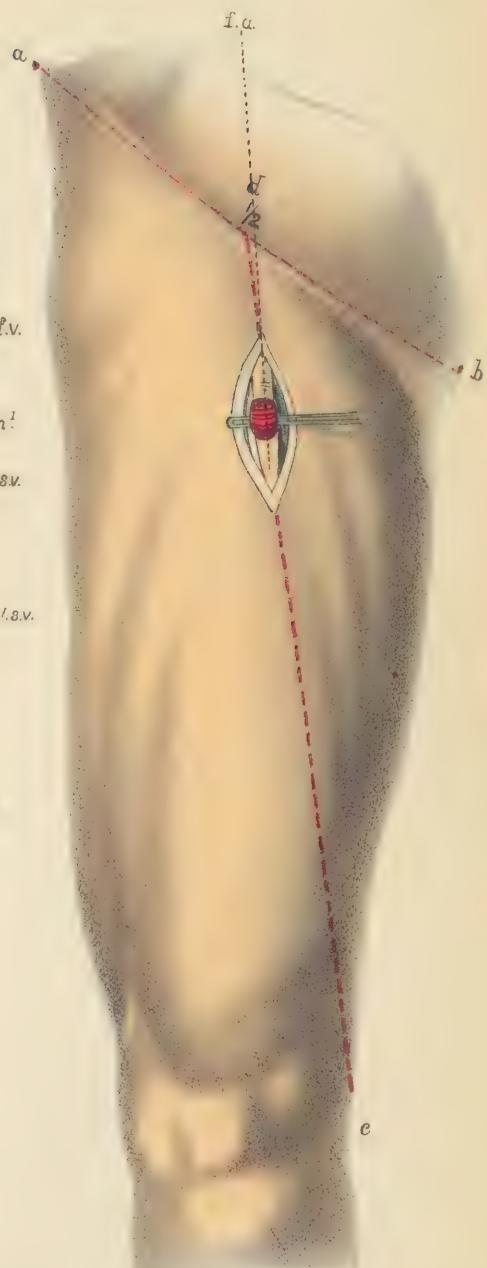
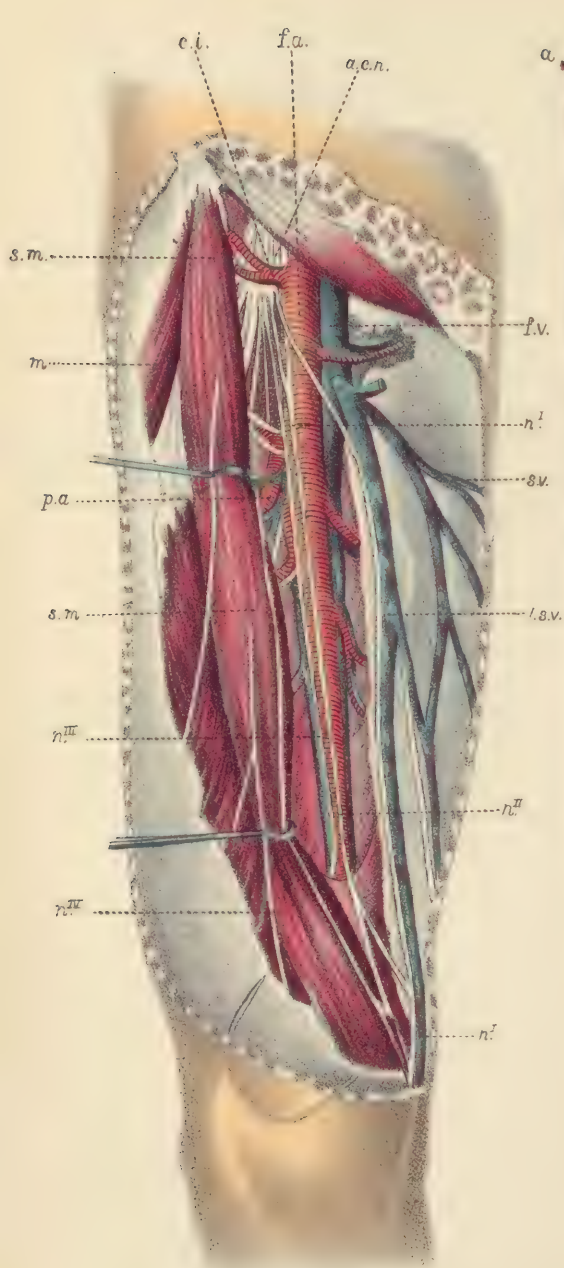
- a. b.* Line of Poupart's ligament.
- b.* Pubic bone.
- f. v.* Femoral vein.
- f. a.* Femoral artery.
- s. m.* Sartorius muscles drawn back by hooks to show vessels and nerves beneath.
- p. a.* Profunda artery.
- a. c. n.* Anterior crural nerve.
 - n.*¹ Branch of the great anterior crural nerve.
- s. v.* Saphenous vein.
- e. p.* External pudic artery.
- c. i.* Circumflex ilii arteries.

Figure II. represents the measurements necessary to open the femoral artery to inject the body, viz.: Take one-half the distance between the central point of the pubic bone (*b*) and the most prominent bony part projection of the flank (*a*). From this midpoint (*d*) a line drawn to the most prominent bony projection on the inner side of the knee lies over the course of the artery which can be most conveniently entered at the point indicated in the cut.

PLATE III.

I.

II.



SECTION III.

- I. THE CHEMISTRY OF THE HUMAN BODY.
- II. PUTREFACTION AND THE CAUSES WHICH HASTEN OR RETARD IT.

THE CHEMISTRY OF THE HUMAN BODY.

BIBLIOGRAPHY: GORUP-BESANEZ, VAUGHAN'S CHEMICAL PHYSIOLOGY AND PATHOLOGY, WHEELER'S MEDICAL CHEMISTRY, TIDY'S HANDBOOK OF MODERN CHEMISTRY, FOWNE'S ELEMENTARY CHEMISTRY, WITTHAUS' GENERAL MEDICAL CHEMISTRY, AND BLOXHAM'S MEDICAL CHEMISTRY.

Having in Section II. briefly outlined the anatomy and histology of the human body, it will be necessary, for its further study with especial reference to its preservation from putrefaction, to remember that the human body is a chemical compound, a complex one to be sure, and one whose composition is not yet fully understood, but no less united in its parts by chemical affinity than is water or salt. Our present concern is not to explain life as a chemical reaction, for life is that which can not as yet be accounted for by chemistry or physics; but if possible to understand the changes which take place in the body after death. These putrefactive changes beyond all dispute come in accordance with the laws of chemistry and without a knowledge of these laws it is impossible understandingly either to arrest or prevent decomposition.

Decomposition in chemistry is the breaking up of a compound into simpler substances. The decomposition of the body therefore implies that it is a compound substance, and such chemists tell us it is, being composed of more than a baker's dozen of elements. Elementary substances are so called because with the means at present at the disposal of chemists they have been unable to break them up into simpler or other substances. All known bodies are then either simple or compound, *i. e.*, they can either be resolved into simpler compounds or they can not.

Less than two hundred years ago it was universally believed that all substances were composed of earth, air, fire and water in varying proportions; and that the dryness, heat, solubility and other properties of a body depended upon the relative amount of the fire or water that it contained. The discovery of oxygen, by Priestly (1774), destroyed this belief, for it proved that all of the so-called elements of that day contained in some form or another oxygen, so that neither earth, air, fire nor water are elements but compounds, for bodies that can thus be resolved

into simpler are called compound bodies; those that cannot be thus broken up are called simple, or elementary. The number of compound bodies is apparently without limits; the number of elementary bodies is about seventy. The annexed table gives their names, symbols, and atomic weights. It is not at all unlikely that many of these substances may eventually be shown to be compound bodies, and probably with new means of investigation others will be discovered, but so long as it is impossible to resolve them into other dissimilar bodies, they are known as elements.

LIST OF ELEMENTS.—(1886.)

NAME.	Symbol.	Atomic Wgt.	NAME	Symbol.	Atomic Wgt.
Aluminium.....	Al	27.4	Mercury (Hydrargyrum).....	Hg	200
ANTIMONY (Stibium).....	Sb	122	Molybdenum.....	Mo	96
ARSENIC.....	As	75	NICKEL.....	Ni	58.8
BARIUM.....	Ba	137	Niobium.....	Nb	94
Beryllium (Glucinium).....	Be	9.4	Nitrogen *.....	N	14
BISMUTH.....	Bi	210	Osmium.....	Os	199.2
BORON *.....	B	11	Oxygen *.....	O	16
Bromine*.....	Br	80	PALLADIUM.....	Pd	106.6
Cadmium.....	Cd	112	Phosphorus*.....	P	31
Cesium.....	Cs	133	Platinum.....	Pt	197.4
Calcium.....	Ca	40	Potassium (Kalium).....	K	39.1
Carbon*.....	C	12	Rhodium.....	Rh	104.4
Cerium.....	Ce	138	Rubidium.....	Rb	85.4
Chlorine *.....	Cl	35.5	Ruthenium.....	Ru	104.4
CHROMIUM.....	Cr	52.2	Selenium *.....	Se	79.4
COBALT.....	Co	58.8	Silicon*.....	Si	28
Copper.....	Cu	63.4	Silver (Argentum).....	Ag	108
Didymium.....	D	144.7	Sodium (Natrium).....	Na	23
Erbium.....	E	168.9	STRONTIUM.....	Sr	87.6
Fluorine *.....	F	19	Sulphur*.....	S	32
Gallium.....	Ga	68 ?	Tantalum.....	Ta	182
GOLD (Aurum).....	Au	197	Tellurium*.....	Te	128
Hydrogen *.....	H	1	Thallium.....	Tl	204
Indium.....	In	113.4	Thorium.....	Th	231.5
Iodine*.....	I	127	Tin (Stannum).....	Sn	118
Iridium.....	Ir	198	Titanium.....	Ti	50
Iron (Ferrum).....	Fe	56	TUNGSTEN, or Wolfram..	W	184
Lanthanum.....	La	139	URANIUM.....	U	240
Lead (Plumbum).....	Pb	207	Vanadium.....	V	51.2
Lithium.....	Li	7	Yttrium.....	Y	92
Magnesium.....	Mg	24	Zinc.....	Zn	65.2
MANGANESE.....	Mn	55	Zirconium.....	Zr	89.6

NEW METALS. [?]

Mosandrium.	Thulium.	Scandium.
Philippium.	Neptunium.	Norwegium.
Yterbium.	Lavoisium.	Holmium.
Decipium.		

N. B. The twenty-four most important of these elements are printed in heavy black type, those next in importance in small capitals. Those marked with a star following are the metalloids, the remainder are metals, and in consequence their names have the termination *ium*.

These elements have been named according to the fancy of their discoverers; their names frequently being taken from the Latin or Greek, and not always being wisely chosen, *e. g.*, oxygen, the most important of all the elements, is named from two Greek words which mean the acid maker, while we shall see later that oxygen is by no means essential to an acid. But it would be hardly profitable to criticise one by one the naming of these elements; neither is it necessary to commit to memory the symbols or contractions usually employed for convenience in writing all the elements, for more than half of them are simply chemical curiosities. We give, however, below, a list of those whose symbols it is desirable to remember, as their compounds constitute the large majority of all the substances with which we are acquainted, and all of these elements are found either in the body or in chemicals useful for its preservation.

Aluminium, discovered by Woebler in 1828 in alum, for which reason he gave it its name. It is a silvery white metal. Symbol (Al^{iv} — Al^{iv})^{vi}.

2. *Antimony* was discovered in the fifteenth century by Basil Valentine. Its English name is said to be derived from two Greek words which mean "against monks," as it was popularly believed to have been used as a poison for them. It is a bluish-white brittle metal. Its symbol is Sb^{iii} , from its Latin name stibium.

3. *Arsenic*, discovered as an element by Schroeder in 1694; the metal had been known under various names since the times of the Greeks. It is a brittle, light, steel-gray solid with a metallic luster. Its symbol is As^{iii} .

4. *Barium*, so named by Sir Humphrey Davy, who discovered it in 1808, in baryta or heavy spar. A pale yellow metal. Symbol, Ba^{ii} .

5. *Boron* was also discovered by Davy, in borax, in 1807. Symbol, Bo^{iii} . Amorphous, crystalline and graphitoid boron are known.

6. *Bromine* was discovered by Balard, a French chemist, in 1826. It is a dense red liquid with a suffocating odor, from which the element is named from a Greek word signifying stench. Symbol, Br^i .

*7. *Calcium* is another of the metals discovered by Sir Humphrey Davy, in 1808. It is a light, yellow, malleable, ductile metal, which tarnishes in the air and decomposes water. It was named from calx, the Latin name of lime, from whence it was first obtained, and its symbol is Ca^{ii} .

*8. *Carbon* is one of the elements which has been known in its various

forms from time immemorial. Like boron it exists in three states, (*a*) Amorphous (Lampblack), (*b*) Graphitoid (Plumbago) and (*c*) Crystallized (Diamond). Its name is from the Latin, and its symbol is C^{iv} .

*9. *Chlorine* was discovered by Scheele, a Swedish chemist, in 1774. It is a pungent, irritating gas and received its name from a Greek word, "yellowish-green," on account of its color. Symbol Cl .

10. *Chromium* was discovered by Vauquelin in 1797, and named from the Greek word for color on account of the brilliant color of many of the chromium compounds. It is a steel-gray, hard, brilliant metal. Symbol, Cr^v .

*11. *Copper* is one of the oldest of metals, being called by the Romans "Cuprum," from its supposed relation to Cyprus and Venus; it still preserves this in its symbol, Cu^{ii} . It is well known to all as a yellowish-red metal, which is very malleable and ductile.

*12. *Fluorine* was probably obtained by Sir Humphrey Davy in 1808 by electrolysis, but from its vehement action on the glass vessels in which it was set free it was impossible to satisfactorily study its physical properties. That obtained by the Knoxes in fluor spar vessels is said to be a colorless gas. It receives its name from fluor spar, where it was first found to exist. Symbol, F^i .

13. *Gold* is too well known to need any description of its appearance or properties. Its symbol is a contraction of its Latin name, Aurum, viz.: Au^{iii} .

*14. *Hydrogen* was discovered by Cavendish in 1766 and receives its name from two Greek words meaning the "water-maker," as water was the original source from which it was obtained. It is the lightest of all known gases, colorless, odorless and readily inflammable and explosive on the application of a flame when mixed with oxygen or air. Symbol, H^i .

15. *Iodine* was discovered by Courtois, a French chemist, in 1811, and named from a Greek word meaning violet, on account of the color of its vapors. It is at ordinary temperatures a black solid, with a metallic luster, characteristic odor, and a violet vapor when slightly heated. Symbol, I^i .

*16. *Iron* known to the ancients as one of the precious metals, has become by modern inventions one of the most common. Its properties are too well known to need description. Its symbol is taken from its Latin name Ferrum. Symbol, (Fe^{iv} — — Fe^{iv}) vi .

17. *Lead* is another of the metals well known to the ancients and largely used at the present time. Its symbol is a contraction of its Latin name Plumbum. Symbol, Pb^{ii} .

*18. *Magnesium* was discovered by Bussy in 1830 and named from magnesia, or its oxide, from which it was first extracted. It is a hard,

white, light, malleable, ductile metal, which in thin bands readily takes fire from a lighted match. Symbol, Mg^{II} .

*19. *Manganese* was discovered by Gahn in 1780. It is a brittle, reddish metal, so hard that it readily scratches steel and is very difficult to fuse. Symbol, Mn^{IV} .

20. *Mercury* is one of the metals that appears to have been known to the earliest of the alchemists. From its fluid condition it was called "water silver" by both the Greeks and the Romans. Its symbol is a contraction of its Latin name Hydrargyrum. Symbol, Hg^{II} .

*21. *Nitrogen* was so named by Rutherford, who discovered it in 1772, from two Greek words meaning maker of nitre, because nitrogen is one of its constituents. Like hydrogen, it is a colorless, odorless gas, but unlike it, it is not combustible. Symbol, N^{III} .

*22. *Oxygen* is also named from two Greek words. Its name denotes that it is the "acid-maker," for the reason that when it was discovered by Dr. Priestley in 1774 it was considered an essential part of all acids. Like nitrogen it is a colorless, odorless gas. It is slightly heavier than nitrogen gas and sixteen times heavier than hydrogen. Symbol, O^{II} .

*23. *Phosphorus* was accidentally discovered in 1669 by Brand, an alchemist of Hamburg, while searching in urine for the philosopher's stone, or the substance which should convert all other substances into gold. Ordinary phosphorus is a flesh-colored solid of about the consistence of wax. Its most remarkable property is that it appears luminous when viewed in the dark, and for this reason it received its name, which was taken from the Greek and means the "light-carrier." Symbol, P^{III} .

*24. *Potassium* is another of the metals discovered by Sir H. Davy in 1807-8. Its name is derived from potash, whence it was originally obtained. It is a silvery white metal which is waxy at ordinary temperatures and burns with a purplish flame when dropped into warm water. Symbol, K^I derived from a barbarous new Latin word invented expressly for this purpose.

25. *Silicon* was found by Berzelius in 1823 and given its name from the Latin word for flint or sand, in which he discovered it. Like carbon, silicon is known in three allotropic conditions, viz.: amorphous silicon, graphitoid silicon and crystallized silicon, the first being a dark brown powder and the form in which it is usually seen. Symbol, Si^{IV} .

26. *Silver* is one of the seven metals known to the ancients, and is so largely used in coin and plate that it needs no description here. To avoid confusion its symbol is not Si , as might be expected, but is taken from the Latin name for silver (*Argentum*). Symbol, Ag^I .

*27. *Sodium* was thus named by Sir Humphrey Davy from sal soda, whence he first obtained this element in 1807. Its appearance and proper-

ties are very like those of potassium, except that the flame is yellow when sodium is dropped into water. The old name for sal soda is natron from which the chemical name of sodium (Natrium) is derived. Symbol, Naⁱ.

*28. *Sulphur* has been known from the earliest times, being mentioned by both Moses and Homer. Its name, sulphur, means the salt of fire, as it was called in the middle ages when sulphur was regarded as the principal of fire and every combustible body was thought to contain it. Sulphur, like silver, gold and a few other of the elements, is found in a native or uncombined condition as a canary-yellow solid, which burns so readily that the name of brimstone or "firestone" was long ago given it. Symbol, Sⁱⁱ.

29. *Tin* was known at least as early as the days of the Romans, who gave it the name of Stannum from which it derives its present symbol. From the slight action at ordinary temperatures of either air or water upon it, tin is largely used as coating for many domestic utensils where its peculiar luster and color are well known. Symbol, Sn^{iv}.

30. *Zinc* was discovered by Paracelsus in the sixteenth century although under the name of spelter, an impure zinc, was used as early as the 13th. It forms the coating of what is known as galvanized iron, and is a bluish-white, crystalline metal which is but slightly acted upon by the air or moisture. Symbol, Znⁱⁱ.

These thirty elements are by far the most important of the list previously given, as from these are formed all of the compounds of practical interest to the embalmer. Those marked with the star are found in the human body. They are fifteen in number and exist there in the following proportions, viz.:

ELEMENTS FOUND IN THE BODY.

Oxygen.....	97.20	lbs.....
Carbon.....	31.10	"
Hydrogen.....	15.20	"
Nitrogen.....	3.80	" (48. 3 cubic feet.)
Calcium.....	3.80	"
Phosphorous	1.75	"
Chlorine.....	.25	" (1½ cubic feet.)
Fluorine.....	.22	"
Sulphur.....	.22	"
Potassium.....	.18	"
Sodium.....	.16	"
Magnesium.....	.11	"
Iron.....	.01	"

13

154 lbs.

And in addition to the above, traces of manganese and copper are

always found in the body. The table given above is that furnished the National museum at Washington, by Prof. Atwater, of Wesleyan University. Prof. Lancaster, of London, some years ago decomposed a human body weighing 158.4 lbs., and at a popular lecture exhibited the results which do not exactly coincide with those given above. His figures, as taken from a newspaper clipping, are as follows:

CONSTITUENTS OF A HUMAN BODY.

Oxygen.....	1.095 cubic feet.
Hydrogen.....	27.590 " "
Nitrogen.....	52 " "
Carbon.....	23.1 lbs
Lime.....	2.2 "
Phosphorus.....	22.3 oz.
Sodium	} 1 oz each.
Iron	
Potassium	
Magnesium	
Silicon	
Traces of sulphur, copper and fluorine.	

The former table is probably the more nearly exact, but in the nature of the case either is only approximative. The essential part of both is the fact that chemically the human body is composed of fifteen elements, viz.:

5 GASES.....	{	Oxygen.
	{	Hydrogen.
	{	Nitrogen.
	{	Chlorine.
	{	Fluorine.
3 METALLOIDS..	{	Carbon.
	{	Phosphorus
	{	Sulphur.
7 METALS.....	{	Calcium
	{	Potassium.
	{	Sodium.
	{	Magnesium.
	{	Iron.
	{	Manganese.
	{	Copper.

Chemical Affinity is the power or force that binds these various elements together; for it must be remembered that a human body is not constructed of its various elements simply mixed together. Years ago some of us read of an insane Frenchman, who had gathered together in a vast receptacle all of the elements in the proper proportions to construct a man, and according to the apocryphal tale, was engaged in agitating them together, hoping that at last blind chance would bring them together in such happy apposition that a new Adam would be the result.

But chemistry teaches that there is no such thing as blind chance. Bodies are not made up of matter simply thrown together, but of matter bound together by one of the strongest of material forces, which the chemists in lieu of a better name now generally call

CHEMISM,

or chemical affinity. Like many other things of which we have but partial knowledge, Chemism has been called by many names. One of the first of these was Elective Gravitation, another Molecular Gravitation, another Chemical Attraction. The term Chemical Affinity was invented by Stahl, but the theory on which it is explained was foreshadowed in the writings of Lucretius. This atomic theory, as it is now called, will be taken up more in detail later. For the present it is sufficient to say that it presupposes all matter to be composed of a multitude of infinitely small bodies called atoms, which are held together by this force of chemical affinity. If the atoms are of the same kind we have a simple or elementary body; if there are dissimilar atoms held together by chemism then we have a compound body, but in either event it is chemical affinity which binds the atoms together. Just what chemism is, we know no more than we do what is heat, light, electricity or any other force. It is closely allied to electricity, possibly, it is one of its manifestations. Chemical decomposition, under the proper surroundings, will produce an electrical current, and, *vice versa*; a galvanic current will break up a compound body sending one kind of its atoms to one pole and the others to another, showing that elements of unlike polarity are usually combined together. So generally is this true that the elements are frequently arranged in series according to the position they take at the poles of a galvanic battery, when a substance containing dissimilar atoms is broken up by sending a galvanic current through it. (See table of electro-chemical series, later.)

Such a table is of great value in the naming of chemical compounds as we shall see later; for the present it is referred to merely to emphasize the fact that chemism usually holds together atoms unlike in polarity. Two positive or two negative atoms may combine and do, but it is often difficult to say whether such compounds are held together by chemical affinity or mechanical attraction.

While there is much that we desire to know concerning the force we call chemism there are certain facts that are established in reference to it, and that need to be borne in mind for a clear understanding of the chemistry of the body.

1. Then, it may be said that chemism is closely related to the other forms of force for all of their manifestations—heat, light, and the electrical current may and do result from chemical action.

2. It is elective in its action, *i. e.*, the various atoms have not like

affinity for each other. For instance, the chlorine atom has a much greater liking or affinity for the hydrogen atom than it has for an atom of oxygen. If the atoms were as changeable in their affinities as human kind, chemistry would be the most bewildering of all sciences; but fortunately this is not so, for having once learned the chemical likes and dislikes of an element they are known for all time. For like the laws of the Medes and Persians which change not, under the same circumstances, the chemical affinity between two or more elements, always remains exactly the same; therefor:

3. Chemical affinity under the same circumstances is invariable.

4. Chemism only acts at inappreciable distances and exerts its power in one of the five following ways, viz.: by

- (a) *Union* between similar or unlike atoms. In chemistry this is known as synthesis.
- (b) *Resolution*, or the separation of complex compounds into simpler, or elementary substances.
- (c) *Displacement*, or the substitution of one atom for another, as when zinc is dropped into muriatic acid and replaces its hydrogen by the metal.
- (d) *Exchange*, or double decomposition consists of a mutual exchange of atoms between two compounds, analogous to exchanging partners in a quadrille.
- (e) *Re-arrangement* is not a change of atoms but simply a change in their relative position as regards each other.

Having thus briefly glanced at the methods in which chemism acts we are in position to consider more carefully

THE ATOMIC THEORY,

on which modern chemistry rests. The thought that all matter is composed of a multitude of indivisible particles, or atoms, seems to have been dimly grasped by Lucretius, and others of the ancients; but in its present form it was first suggested by Wenzel, a German chemist, who published a work on "The General Theory of Affinities," in 1774. This, in reality, contained the germ of the atomic theory; for it is there noted by Wenzel that when two neutral salts, such as sodic sulphate and plumbic acetate, are mixed together, an exchange of acids takes place, but that, nevertheless, the resulting products are neutral, proving, as he remarked, that the acid of the one salt was sufficient for the base of the other salt. In other words, Wenzel, without clearly understanding the law of atomic weights, discovered the principle now laid down as one of the fundamental laws of chemistry, viz.:

When elements unite to form a definite chemical compound, they always combine in the same proportions by weight. This law was still further

elaborated, in 1792, by Richter, a chemist, who wrote a work on the Mathematics of Chemical Elements. This was mainly directed to illustrating the relative quantities of acid and base necessary for saturation.

The theory of atomic weights, however, was first definitely formulated by Dalton, who, in studying the compounds of hydrogen and carbon, in 1800, noted the fact that where these *substances united in more than one proportion, the higher proportions were always multiples of the lower*, or what is now known as the second law of chemical combination, for the law is as true concerning carbon and oxygen, or any two of the elements, as it is concerning carbon and hydrogen. From these facts he constructed what has been called Dalton's Atomic Theory.

1. That all matter is composed of indivisible and indestructible particles called atoms. (From the Greek, meaning uncuttable.)
2. That the atoms in a mass do not touch.
3. That they are endowed with attractive and repulsive forces.
4. That they have specific weights.

The last fact is really the (only) discovery of Dalton, for the atomic constitution of matter, and its law of definite combinations had been stumbled upon by earlier observers; but to Dalton belongs the credit of surmising that the atoms had definite weights, differing with each kind of elementary matters and that these atoms combined only in the proportion of their weights or multiples thereof.

ATOMIC WEIGHT.

The actual weight of a single atom is so infinitesimal that it would be impossible to weigh one, even if it could be isolated. How then can it be proven that atoms differ in their weights? Only by inference from another fact proven by physicists, viz.: that equal bulks of gas of any kind, contain equal numbers of atoms. Now, if all atoms had the same weights equal bulks of gas ought to weigh exactly the same. But they do not, for equal bulks of oxygen and hydrogen, for instance, stand in the relation to each other of sixteen to one in weight: consequently, if they contain the same number of atoms, as proven by physics, the atom of oxygen must weigh sixteen times as much as the atom of hydrogen. Similar experiments have proven that the carbon atom is twelve times heavier than the hydrogen atom; and in fact, the whole column of atomic weights given on page 108, similarly compares the weight of an atom of any element with that of hydrogen taken as the standard. These comparative weights of the atoms (hydrogen as the lightest body known, being regarded as 1.) are called atomic weights. Atomic weights, therefore, are relative weights, but not absolute weights. For example, when we say that mercury has an atomic

weight of 200, we mean that the atom of mercury would weigh 200 times as much as the atom of hydrogen; but inasmuch as we cannot determine the exact weight of the hydrogen by scales, the number 200 does not express the absolute weight of the mercury atom in pounds, ounces, or grains; but simply says mercury vapor is 200 times heavier than hydrogen gas. So that if we wish to be absolutely accurate, we may define "the atomic weight of an element as that weight which it would occupy, in the state of gas, of the same volume as the unit weight of hydrogen under the same temperature and pressure." (Tidy.) If, however, we cannot obtain the element in a state of gas as *e. g.* in the case of carbon, the atomic weight is then deduced from other considerations, such as the specific heat of the body, etc. Much of this may appear wearisome in its detail and reiteration; but it is so essential to an understanding of chemical symbols and equations that at the risk of prolixity we desire to emphasize the results arrived at by the adoption of the atomic theory viz.:

The three laws of Chemistry.—1. The same substance always consists of the same elements combined in the same proportion; *e. g.*, having once learned the composition of water, water will always be found to have the same constituents, combined in the same proportions, wherever water may be found.

2. When one element combines with another in several proportions, the higher proportions are always multiples of the first, or lower; as, for instance, in the case of nitrogen and oxygen, where we find the oxygen uniting with the nitrogen in the ratio of 16, 32, 48, 64 and 80, or in multiples of sixteen.

3. If two elements combine with a third, the proportions in which they will combine with that third element are the same, or measures or multiples of the proportions in which they combine with each other. This will be more fully explained under the head of Valence, later.

We are now prepared to fully understand the meaning of the symbols already given on page 108, and which are of the greatest value to the student of chemistry for many reasons. One of these reasons is the saving of time obtained by the use of formulæ and equations to express chemical compounds and reactions. We might, for instance, write at length that white vitriol, or sulphate of zinc, is prepared by the addition of the proper proportions of metallic zinc to sulphuric acid, which are those of 65.2 parts of zinc to 98 parts by weight of sulphuric acid, or we may in chemical shorthand, so to speak, write the whole story as follows: $\text{Zn} + \text{H}_2\text{SO}_4 = \text{H}_2 + \text{ZnSO}_4$, for this half line tells all and more than three lines above required for its telling. This is accomplished by means of chemical symbols and formulæ which are by no means the unmeaning hieroglyphics they are often thought to be.

Symbols are as old as the days of the alchemists, who used those of the planets to denote the seven metals then known. Some of these names have come down to the present time, as for instance, nitrate of silver is sometimes called lunar caustic for the reason that silver had the symbol of the moon, and thus this salt has been known in consequence as lunar or "moon-caustic" ever since.

With a better knowledge of the laws of chemistry these symbols were of course dropped and the first letter, or letters, of the names of the elements have been adopted to denote a single atom of any of the elementary substances. (See page 108.) When it is wished to express more than a single atom of any element, small figures are used below and to the rear of the symbol: thus five atoms of hydrogen would be written H_5 , or, as it is frequently done, though not so well, unless it is meant to multiply several symbols by the same number, $5H$. A grouping of symbols is known as a formula, (plural formulæ); *e. g.*, $ZnSO_4$ is the formula expressing white vitriol, and it tells us exactly how white vitriol is composed; for the formula tells the reader that this salt contains one atom of zinc, one atom of sulphur and four atoms of oxygen. And furthermore than this, it informs him of the proportions by weight in which they are combined, for as each atom has its own weight, $ZnSO_4$ tells us that to form white vitriol it is necessary in some way to combine zinc, sulphur and oxygen in the proportions of $65.2 + 32 + 4 \times 16$. How this can be done and what shall be the name given to the resulting compound comes naturally later. At present we are chiefly concerned with the white vitriol molecule ($ZnSO_4$), for this name, from the Latin *molecula*, a little mass, is given to any grouping together of atoms, held together by chemical affinity.

MOLECULES.

"A molecule," according to Tidy, "is the smallest possible cluster of elementary atoms capable of existing as a compound, and of having an independent chemical action." Now, as the smallest possible cluster of which we can think is two, it follows that a molecule may contain any number of atoms from two upwards. These atoms may be similar or dissimilar, and, consequently, a molecule may be either simple or compound. A simple molecule is one which is made up of the same kind of atoms held together by chemical affinity; consequently simple molecules are only found in simple or elementary bodies. $ZnSO_4$ is evidently not that kind of a molecule, for it contains three different kinds of atoms, *viz.*: zinc, sulphur, and oxygen. It is, therefore, a compound molecule, *i. e.*, one made up of two or more different kinds of elementary atoms. As each symbol expresses both some kind of elementary matter and its relative or atomic weight, the sum of these weights must express that of the molecule. If, therefore, $ZnSO_4$ is the formula of white vitriol, and Zn de-

notes an atomic eighth of 65.2.; S that of 32, and O_4 equals 16×4 , then the molecular weight of $ZnSO_4$ equals 65.2 plus 32 plus 4×16 , which gives as its molecular weight 169.2. Similarly 18 is the molecular weight of water, which has the formula H_2O (See table of atomic weights, page 108.) The molecular weight of any substance may be obtained by adding together the atomic weights of its constituent symbols.

It is more than likely that all we know concerning chemism is what has been learned from these molecules, for it is very improbable that the atoms ever exist uncombined. Even elementary matter is undoubtedly composed of molecules of two or more atoms linked together by chemical affinity. In fact, the study of these molecules, and the possible changes that may be produced in them constitutes modern chemistry, which has been admirably defined by Barker as that branch of physical science which treats of the "alterations in kind, number or relative position of the atoms which compose the molecule." The different kinds of atoms have, perhaps, been sufficiently dwelt upon on pp. 109-112, as has also the laws of their combination by definite weights or proportionate multiples of the same, but there is still another law or discovery which has so important a bearing on the formation of the molecule that we shall devote the following section to it.

VALENCE, OR EQUIVALENCE

is one of the more recently discovered properties of atoms, which are now believed to differ one from another, not only in kind and weight, but also in combining power. Atomic weight is the relative weight of an atom as compared with hydrogen. *Valence is the combining power of an atom measured by hydrogen.* To illustrate, let us return to the equation used on page 117 to express the manufacture of white vitrol ($ZnSO_4$) from zinc and sulphuric acid. This equation runs as follows: $Zn + H_2SO_4 = ZnSO_4 + H_2$. Now as in algebra, one side of an equation must exactly balance or equal the other, it clearly appears that an atom of zinc is the equivalent of two atoms of hydrogen. If instead of Zn in the equation we substitute caustic potash or KOH we shall have the following reaction, viz.:



or one molecule of caustic potash when added to one of sulphuric acid produces a compound of potassium, hydrogen, sulphur, oxygen and water. From reasons to be given later this compound of potassium, hydrogen, and sulphur is called acid or bisulphate of potash, and is produced by substituting one atom of potassium for one atom of hydrogen in the formula H_2SO_4 , which has already been given as that for sulphuric acid. As we have also another sulphate of potassium (K_2SO_4) in which two atoms of potassium (K_2) are substituted for the atoms of hy-

drogen (H_2) in sulphuric acid, it follows that we have in chemistry atoms whose value is equal exactly to one atom of hydrogen, as is true in the case of K: others whose atom as that of zinc (Zn) can substitute two of hydrogen, as seen in the equation referred to so often before viz.:



Atoms that have a valence, or an equivalence of one atom of hydrogen, *i. e.*, those that can be substituted for one atom of hydrogen are called *monads*; those whose valence is two are known as *dyads*; those equal three, *triads*; four, *tetrads*; five, *pentads*; six, *hexads*, from the corresponding Greek numerals. The valence of an atom is usually denoted by a small, Roman numeral placed above and to the rear of a symbol as may be seen in the symbols on page 109–112, and in the annexed list which gives the hydrogen compounds of the more important elements, at the same time giving their valence also :

HYDROGEN COMPOUNDS ILLUSTRATING VALENCE.

$\overset{i}{H}\overset{i}{Cl}$	$\overset{i}{H_2}\overset{ii}{O}$	$\overset{iii}{P}\overset{i}{H_3}$	$\overset{iv}{C}\overset{i}{H_4}$	} etc.
$\overset{i}{H}\overset{i}{Br}$	$\overset{i}{H_2}\overset{ii}{S}$	$\overset{iii}{As}\overset{i}{H_3}$	$\overset{v}{P}\overset{i}{H_5}$	
$\overset{i}{HI}$	$\overset{i}{H_2}\overset{ii}{Se}$	$\overset{iii}{Sb}\overset{i}{H_3}$	$\overset{iv}{Fe_2}\overset{i}{H_6}$	
$\overset{i}{HF}$	$\overset{i}{H_2}\overset{ii}{Te}$	$\overset{iii}{N}\overset{i}{H_3}$		

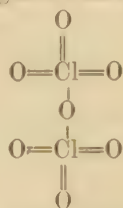
From what has already been said, it follows that the elements, including hydrogen, in the first column must be monads; those in the second, dyads; those in the third, triads, and those in the last various, as may be learned from their distinguishing marks. There can be no difficulty in understanding the valence of any of the elements in the list until we come to the last, Fe_2H_6 , which is apparently a contradiction of what has already been said, for the iron atom (Fe) has the mark of a tetrad; and yet two of its atoms, instead of equalling (2×4) atoms of hydrogen, as they ought according to the law already laid down, are apparently satisfied or equal to six atoms (H_6) of hydrogen. The explanation on this brings us to another fact, viz.:

The valence of an element is not invariable. Where there is more than one valence to an atom, they differ one from another usually by two. Thus we have compounds of chlorine and oxygen as follows: $\overset{i}{Cl_2}\overset{ii}{O}$; $\overset{iii}{Cl_2}\overset{ii}{O_3}$; $\overset{v}{Cl_2}\overset{ii}{O_5}$; $\overset{vii}{Cl_2}\overset{ii}{O_7}$; or molecules in which chlorine has a valence of one, three, five and seven, as the valence of oxygen is always two. Carbon (C) also forms oxides— $\overset{ii}{CO}$ and $\overset{iv}{CO_2}$ —in which it has a valence of two and four, respectively. This variation in valences by two is so frequent that various explanations have been sought, and of these the most reasonable one is that which seeks its explanation in what is

known as self-saturation, which can be best explained graphically, or by rude diagrams. We may denote the valence of an atom by the Roman numerals, as already used, or we may express the equivalence of an atom in hydrogen by drawing lines from its symbol in various directions, meaning thereby that each of these may be united with an atom of hydrogen or its equivalent. For instance: Cl^{I} denotes that the chlorine atom here is a monad; $\text{Cl} -$ denotes the same thing, and $\text{Cl} - - \text{H}$ would mean that its valence had been united or saturated with hydrogen. As — H_3 means that arsenic has a valence of three, and that *its bonds* (for so these marks of valence are generally called) are all satisfied by the three atoms of hydrogen affixed.

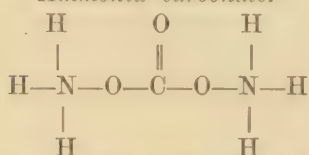
The same method might be used to express any valence of an atom or all those of a molecule. Take for instance the highest oxide of chlorine

in which the valence of chlorine is seven Cl_2O_7 . It might be represented thus, oxygen always having an equivalence of two and consequently satisfying two bonds anywhere. Some of these graphic formulæ are apparently quite complex, but their intri-



cacy is more apparent than real for the most complicated graphic symbol is nothing more than a convenient device to explain the theory

Ammonia carbonate.



that all the bonds or valences of each atom in a molecule must be equalized or satisfied by the bonds or valences of other atoms in the molecule. The present theory, then, is that atoms cannot

exist with uncombined bonds or valences, but that they themselves may satisfy some of these bonds. According to this theory the true valence of an element is always its highest, but by its bonds pairing off two by two it may act with a lower valence. For instance, chlorine is such, and according to this theory its true quantivalence is seven, but supposing two of its bonds mutually satisfy each other, we then have a chlorine atom with a valence

of five according to annexed graphic formulæ.



If now two more do the same, the number of bonds in the above chlorine atom then left to be saturated or satisfied, would be three, and by repeating the process we have a monad chlorine atom or one with only one unsatisfied bond. Below that, of course, its valence cannot fall; and for the reasons given above every change in the valence of an element must be by two bonds or its multiple, for less than a pair cannot saturate one another.

But, asks the reader, how can one know what is the valence of any given element if it changes so often? Generally the other atoms in a molecule help us to answer this question for usually when there is one atom of a variable valence in a molecule the others are those of a settled valence; so that by a very simple calculation we arrive at an answer if we remember that a molecule is always a chemical compound of completely satisfied bonds. Further illustrations of this will be given as from time to time it shall be convenient to use graphic formulæ in the explanation of chemical compounds; but for the present it is sufficient to remember that every molecule is composed of atoms all of whose bonds are satisfied, and that these atoms may occasionally satisfy their own bonds, two at a time, or two atoms may join together to form what is known as a

COMPOUND RADICAL.

Such an one is met with in the compound $\text{Fe}_2\text{H}_6^{\text{iv}}$, where the Iron (Fe) atom is apparently a triad, and yet in the other compounds, in which we meet with the iron atom it is clearly a dyad. This is so contrary to the rule, that atoms change their valence only by two, or its multiples, that it needs an explanation and this is furnished in the existence of what is known as a radical. These radicals were originally defined as *an element that may be transferred from one combination to another in exchange for one or more atoms of hydrogen or its equivalent*; but latterly it has been found that elementary atoms are not the only ones that can thus be transferred; for certain unsatisfied groups of atoms may thus pass from one combination to another exactly as does the unsatisfied atom. This group of atoms whose valences are not satisfied if it can pass from one combination to another is called a radical; which name it ought to be remembered is also applied to the elements as the roots or the essential parts of a molecule. And it is only because these unsatisfied groups of atoms can pass from one combination to another as the elements that they are given the same name radical; for it must be remembered that all unsatisfied groups can not act in this way, but only those in which there is enough coherence between the atoms to enable them to act as simple radicals or elements. These radicals, like the elements, may be monad, dyad, triad, etc., and to distinguish them have been given names ending in yl. Hydroxyl, which is the $[\text{H}-\text{O}]^-$ most important of them all is here illustrated graphically. As oxygen is always dyad, or has two bonds, and hydrogen is always monad and has one bond only, it follows that one atom of oxygen united to one atom of hydrogen would leave one of the bonds unsatisfied as represented above. Now as it is found that this combination of oxygen and hydrogen may be made to pass from one molecule to another like a simple element, or radical, we call it a compound radical.

since it contains more than one kind of atom, and name it *hydroxyl*, from its likeness to water in its chemistry. This hydroxyl radical is one of the most important in modern chemistry, for we shall learn hereafter that by its union with hydrogen it forms water; by its union with a metal, or a positive radical, it forms the hydrates or bases; and by its union with a negative radical, it gives us the almost innumerable list of acids.

PSEUDO-VALENCE.

In a brief résumé of chemistry, such as this, it would hardly be profitable to give a list of even the more important compound radicals. Their names will be given as there arise occasions to use them, so that for the present the subject is dismissed with an explanation only of the compound radicals found in the alum and ferric salts, both of which are among those used as preservatives. According to their tabulated valence both are tetrads, or atoms with four bonds, and yet they enter into combination apparently as triads. This can be best explained by a reference to $\text{---} \overset{\text{iv}}{\text{Al}} \text{---} \text{---} \overset{\text{iv}}{\text{Al}} \text{---}$, the list of the thirty more important elements (page 109) where the double aluminium atom is graphically represented as above, showing that by self saturation it has only six bonds left free to enter into combination, hence the $\overset{\text{iv}}{\text{Al}}_2 \overset{\text{i}}{\text{Cl}}_6$ formula for its combination with chlorine (Cl) would read, $\overset{\text{iv}}{\text{Al}}_2 \overset{\text{i}}{\text{Cl}}_6$. There is a corresponding salt of iron and a similar combination $\overset{\text{iv}}{\text{Fe}}_2 \overset{\text{i}}{\text{H}}_6$ with hydrogen, given on page 119, where it may be noted that the Fe atoms form a compound $\overset{\text{iv}}$ radical with a valance of six exactly like that shown in the case of Al. Such compound atoms are said to have a false valence, and are consequently known as pseudo-triads, monads, etc., as the case may be.

NOMENCLATURE.

Thus far we have used only the ordinary or popular names of the chemicals referred to. These have been given them for the most varied reasons: many are named from their fancied resemblance to other things often chemically most unlike; for instance sulphuric acid is often called oil of vitriol from its oily appearance, although it is anything but oily in its behavior. Others were named from some remarkable property of theirs, as ammonia gas is still known as volatile alkali, and other chemical compounds are called by the names of their discoverers, as Glauber's salt and the salt of Algaroth. We shall endeavor in the section on Antiseptics and Disinfectants to give as far as possible both the former and modern names of all the substances used for these purposes; but in the present section the time has now arrived when only the proper chemical names should be given to the compounds which we are called upon to further consider, for chemical salts are at present no longer called after the fancy of their discoverers, but are named according to definite rules, so that

the name of a chemical compound expresses its composition as explicitly as its symbols give its atomic weight. Our present system of nomenclature was suggested in 1781, by Guyton de Morveau, who proposed that the name of a body should indicate somewhat its properties and composition, and should have its root in the dead languages. In 1787 he obtained for this purpose the assistance of the French Academy of Sciences, and Lavoisier, Berthollet, and Fourcroy, were appointed to assist him in the task. The system suggested at that time is essentially the one in use at the present, and is both simple and accurate.

The names of the elements, as has already been said, were mainly selected from individual fancy, and with the exception of azote, which was formerly the French name for nitrogen, have remained unchanged, although, with our present knowledge, better names might be chosen for many of them.

Binary compounds are those in which two elements or radicals combine to form the molecule, and are always indicated by the termination *ide*. An oxide, then, is a binary compound, containing oxygen united to a more positive element or radical; for the termination *ide*, always belongs to the negative element, while the positive element remains unchanged, or takes the ending *ic*. Thus KI is the formula for a binary compound, since it indicates a molecule containing two different elements, potassium (K) and iodine (I). Its name, consequently, ends in *ide*, and as the *ide* is added to the negative element (always written last in formula) it would be an iodide of some kind. The earlier method was to call it an iodide of potassium, or iodide of potash, but latterly the name would be potassic iodide.

Sir Humphrey Davy suggested that the terminations in these cases should indicate property; *ide* being employed only for acids, and *uret* for alkaline compounds, but the suggestion has never come into general use although the term *sulphuret* is sometimes used in the place of sulphide; and furthermore the word anhydride is occasionally applied to those oxides which on the addition of water form an acid (see acids). The name of a binary compound ought then to present no difficulties except in the decision of which is the positive and which the negative radical, or element.

ELECTRO CHEMICAL SERIES.

<i>Positive Elements</i> because found at negative pole or cathode.	Cæsium.
	Rubidium.
	Potassium.
	Sodium.
	Lithium.
	Barium.
	Strontium.
	Calcium.
	Magnesium.
	Glucinum.
	Yttrium.
	Erbium.
	Aluminium.
	Zirconium.
	Thorium.
	Cerium.
	Didymium.
	Lanthanum.
	Manganese.
	Zinc.
	Iron.
	Nickel.
	Cobalt.
	Thallium.
	Cadmium.
	Lead.
	Indium.
	Tin.
	Bismuth.
	Uranium.
	Copper.
	Silver.
	Mercury.
	Palladium.
	Ruthenium.
	Rhodium.
	Platinum.
	Iridium.
	Osmium.
	Gold.
	Hydrogen.
	Silicon.
	Titanium.
	Tantalum.
	Tellurium.
	Antimony.
	Carbon.
	Boron.
	Tungsten.

Practice soon teaches that the oxides, the sulphides, the iodides, bromides, fluorides and phosphides are the usual binary compounds, and that in consequence oxygen, sulphur, nitrogen, fluorine, chlorine, bromine and phosphorus are most frequently found of the negative elements. Whenever the case is in doubt it can be settled by reference to the annexed list, which gives the polarity of the elements in reference to one another; the positive elements being found at the top of the column and the negative at the bottom. It should also be remembered that each element is positive to all below it and negative to those above, so that an element that stands midway may be both positive and negative according to its combination. Such a one is hydrogen, which in combination with zinc would form a hydride ZnH_2 but if found in combination with oxygen becomes the positive element, and consequently the oxygen takes the termination ide and the compound is known as oxide of hydrogen (H_2O).

One further point in regard to these binary combinations requires our attention and that is when a negative element enters into combination with a positive element which has more than one valence. Thus tin (Sn)^{ii-iv} and chlorine (Cl)ⁱ combine to form chlorides in one of which the tin atom has four bonds to be satisfied by the monad chlorine, and in the other by self saturation it has but two left for the chlorine. Two methods have been de-

vised to meet this case: the first of which is the one usually employed. This is the use of a suitable termination for the positive as well as the negative element. The endings used are *ic* and *ous*. The termination *ic* is given to the positive constituent (Sn.) of the compound when it contains the largest proportion of the negative constituent (Cl), and the termination *ous* to the positive constituent, when the compound contains the smallest proportion of the negative constituent. For example: The SnCl_4 , containing more of the negative element (Cl) than SnCl_2 , is known as stannic chloride and the other as stannous chloride.

Negative because
found at
positive
pole.

Molybdenum.
Vanadium.
Chromium.
Arsenic.
Phosphorus.
Selenium.
Iodine.
Bromine.
Chlorine.
Fluorine.
Nitrogen.
Sulphur.
Oxygen.

2. The other and less frequently used method is to indicate indirectly this difference in valence by prefixes added to the negative element. These prefixes are taken from the Latin or Greek numerals, and thus indicate the number of the negative atoms used. For instance, we have two oxides of carbon ($\text{C}^{\text{iv}}\text{O}_2$ and $\text{C}^{\text{ii}}\text{O}$), in the first of which carbon manifestly acts the part of a tetrad (C^{iv}), and in the other as a dyad (C^{ii}). According to the rule previously given, these oxides would be known as carbonic oxide and carbonous oxide respectfully, but they may also be called carbonic monoxide, and carbonic dioxide, according as they have one or two atoms of oxygen. The Greek prefixes are *mono*, *di*, *tri*, *tetra* and *penta*, for one, two, three, four and five respectively, or the Latin numerals may be used instead, for there is no rule as to which shall be chosen. Other prefixes are occasionally used, viz:

1. *Per* denotes the highest compound in a series. For example, a peroxide signified that oxide which contains the largest quantity of oxygen in a series of oxides.

2. *Sesqui* denotes a compound where the relationship of the elementary atoms is as two to three. For example, sesquioxide of iron (really ferric oxide) has the formula Fe_2O_3 . (See Pseudo-Valence.)

3. *Proto* (from the Greek, first) denotes the first of a series of compounds. For example, the protoxide of iron (FeO , better called ferrous oxide), contains the smallest quantity of oxygen of any iron and oxygen compound.

4. *Para* signifies equal. For example, paracyanogen implies a body chemically equal to cyanogen.

5. *Sub* indicates that the compound contains less of the constituent than another compound of the same name.

TERNARY COMPOUNDS.

The naming of ternary compounds, or those which contain three elements, or radicals, is a little more intricate, but can be easily mastered by anyone who really wishes so to do. And first, it should be remembered that the usual termination for the name of a ternary compound is either *ate* or *ite*, according to the valence of the negative element, or radical, for ternary compounds, like binary, contain positive and negative elements, but the ternary compound, unlike the binary, does not join these elements directly together, but links them by a third. The element which most frequently acts the part of the link is oxygen. A very large proportion of the ternary compounds known to chemistry contain linking-oxygen, and are said to be made up on the type of water. $[H^+ - [O^{ii}] - H^-]$. Now if we substitute for the negative hydrogen atom an atom of some metal, or a positive radical, we shall have what is known in chemistry as a base or *hydrate*.

A *base* or *hydrate*, then, is a positive element or radical, linked to one or more atoms of hydrogen by as many atoms of oxygen. $K-O-H$, according to this rule, would be a base, for it contains a positive atom (K) linked to one atom of hydrogen by a single atom of oxygen. The bases have an alkaline reaction, that is, turn a red litmus paper blue.

An *acid* differs in theory from a base only in having a negative atom or radical—more frequently the latter—linked by oxygen to hydrogen. These acids have a sour taste, and turn blue litmus paper red.

A ternary *salt* is one that is formed by the union of an acid and a base; thus, potassic base added to nitric acid gives saltpetre and water, or, graphically, $K-OH + H-O-(N^vO_2) = H-OH + KONO_2$, or, chemically speaking, one molecule of potassic hydrate, added to one of nitric acid, displaces its hydrogen radical by potassium and forms a salt. And how shall this salt be named? By the rule previously given it must have the termination “ate” or “ite” to denote that it is a ternary compound. Whether it shall be *ate* or *ite* depends upon the valence of the negative element, which in this case, by reference to the table on page 119, will be found to be nitrogen, for *oxygen in ternary compounds always acts as the link or is utilized in the radical*, hence they are named from some other element. If these ternary compounds were all written graphically we could tell at a glance whether they were bases, acids, or salts; but as they are usually written it takes some little ingenuity to do so; but nevertheless, it is not difficult if we bear in mind the distinctions between an acid, base, and salt previously given. Under these KOH is clearly a base because it contains a positive radical (K) linked by oxygen to hydrogen. KNO_3 , or as it is better written, $K-O-NO_2$, is evidently not a base, for although it contains the same positive atom and linking oxygen

they are not joined to hydrogen. Nor is hydrogen found in the compound, therefore it cannot be an acid, for nowadays it is taught that no acid can exist without its containing replaceable hydrogen. K O-NO_2 , or KNO_3 as it is more frequently written, if neither acid nor base and a ternary compound, is probably an ate, or an ite salt. Which? That depends upon the valence of nitrogen as has already been said. On turning to our list of elements we find that the valence of nitrogen is usually three. Is it so here? No, because if it was triad, K-O-NO_2 would be an unsatisfied compound, for oxygen has always two bonds, and in no possible way could a triad element satisfy more than three of them.

In the present molecule the oxygen atoms have altogether six bonds, but one of these is satisfied by the monad element (K), so that as $\text{O}_5=6$ nitrogen (N) must have a satisfying power equal to five atoms of hydrogen, consequently its valence is five, or one of the higher valences of nitrogen, and consequently it is a *nitr(ogen)ate*, or, by dropping the superfluous syllable, a nitrate. Now, if a nitrate, it must be a nitrate of something, and the positive element (K) tells what this is; viz., potassium; so that at last, by this round about process we have arrived at the conclusion that KONO_2 or KNO_3 , represents potassium nitrate, or nitrate of potassium.

What we desire in the naming of these ternary compounds is some easy method of arriving at the valence of the negative element, for that found the naming of the compound is comparatively easy. The simplest rule is this: deduct from twice the number of the oxygen atoms in the compound the valence of the positive atoms, and the resulting number will, except in a few exceptional cases, give the valence of the negative element; *e. g.*, the valence of sulphur in Na_2SO_4 , according to this rule would be $8-2=6$; therefore, the valence of sulphur in $\text{Na-O-S}^{\text{vi}}=\text{O}$ the molecule is 6, as may be proven by the annexed graphic formula, which shows that a sulphur atom, with a valence of six, would have all its bonds satisfied in the formula $\text{Na}_2\text{O}_2\text{SO}_2$, or, Na_2SO_4 , and, as six is the higher valence of sulphur, the compound would be a sulphate of sodium, or sodium sulphate, as it is better called. Similarly S, in $\text{MgSO}_3=6-2=4$, or the sulphur atom is tetrad, and consequently the formula denotes an ite compound, and as magnesium (Mg) is the positive element, it is a sulphite of magnesium, or magnesium sulphite.

ACIDS.

The same method may be applied to the naming of the acids, which, according to this rule would be known as hydrogen salts: *e. g.*, HClO_4 , or HOCLO_3 would be a hydrogen chlorate, or an ate salt, for chlorine, according to the rule given, would have a valence of $(6-1=5)$ five, and

hence the termination denoting this. The acids may all be readily named, if the valence of the negative element is obtained by subtracting from twice the number of their oxygen atoms the number of their atoms of hydrogen and then calling them either hydrogen salts with their appropriate endings, or *ic* and *ous* acids, remembering that the *ic* termination belongs to the higher valence. The more important of these oxygen acid are given below under both names:

Hydrogen nitrate,	HNO_3 , or HONO_2^{v} =	nitric acid.
" sulphate,	H_2SO_4 , or $\text{H}_2\text{O}_2\text{SO}_2^{\text{vi}}$ =	sulphuric acid.
" chlorate,	HClO_3 , or $\text{HOClO}_2^{\text{v}}$ =	chloric acid.
" carbonate,	H_2CO_3 , or $\text{H}_2\text{O}_2\text{CO}^{\text{iv}}$ =	carbonic acid.
" phosphate,	H_3PO_4 , or $\text{H}_3\text{O}_3\text{PO}^{\text{v}}$ =	phosphoric acid.
" chromate,	H_2CrO_4 , or $\text{H}_2\text{O}_2\text{CrO}_2^{\text{vi}}$ =	chromic acid.
" nitrate,	HNO_2 , or HONO^{iii} =	nitrous acid.
" chlorate,	HClO_2 , or $\text{HOClO}^{\text{iii}}$ =	chlorous acid.
" hypochlorate,	HClO , or HOCl^{i} =	hypochlorous acid.
" borate,	H_3BO_3 , or $\text{H}_3\text{O}_3\text{B}^{\text{iii}}$ =	boracic acid.
" sulphite,	H_2SO_3 , or $\text{H}_2\text{O}_2\text{SO}^{\text{iv}}$ =	sulphurous acid.
" manganate,	H_2MnO_4 , or $\text{H}_2\text{O}_2\text{MnO}_4^{\text{vi}}$ =	manganic acid.
" arsenite,	H_3AsO_3 , or $\text{H}_3\text{O}_3\text{As}^{\text{iii}}$ =	arsenious acid.
" arsenate,	H_3AsO_4 , or $\text{H}_3\text{O}_3\text{AsO}^{\text{v}}$ =	arsenic acid.
" silicate,	H_4SiO_4 , or $\text{H}_4\text{O}_4\text{Si}^{\text{iv}}$ =	(ortho)silicic acid.
" ortho sulphate,	H_6SO_6 , or $\text{H}_6\text{O}_6\text{S}^{\text{vi}}$ =	ortho sulphuric acid.
" ortho nitrate,	H_5NO_5 , or $\text{H}_5\text{O}_5\text{N}^{\text{v}}$ =	ortho nitric acid.
	etc., etc., etc., etc., etc.	

For the list of acids is almost interminable, but perhaps sufficient have been given to illustrate their formation and nomenclature. In so doing we have used a few other terms which need definition. One of these is:

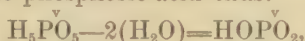
1. *Ortho*, which when prefixed to an acid denotes that it contains as many atoms of hydrogen as it does of oxygen, and that each of these is equal in number to the valence of the negative element; for instance, $\text{H}_5\text{NO}_5^{\text{v}}$ is ortho nitric acid, for the reason that it contains 5 atoms each of hydrogen and oxygen, and this number (5) is exactly

equal to the valence of nitrogen as ascertained by rule previously given, viz.: $5 \times 2 - 5 = 5$, or the valence of nitrogen.

2. *Meta* signifies near to. Thus, metaphosphoric acid only differs from ortho-phosphoric acid by one molecule of water. Ortho-phosphoric acid $\text{H}_5\text{P}\overset{\vee}{\text{O}}_5$ is not given in the above list, but its formula would be $\text{H}_5\text{P}\overset{\vee}{\text{O}}_5$. Now subtracting H_2O from this a molecule of water (H_2O), we should have the formula $\text{H}_3\text{P}\overset{\vee}{\text{O}}_4$, thus:



or ordinary phosphoric acid, although properly speaking it ought to be called meta phosphoric acid to distinguish it from ortho phosphoric acid ($\text{H}_5\text{P}\overset{\vee}{\text{O}}_5$). In fact, to be absolutely accurate it ought to be called mono-metaphosphoric acid, for it is derived from the ortho phosphoric acid by the abstraction of *one* molecule of water; and there is another meta phosphoric acid known, produced by the abstraction of two molecules of water from ortho phosphoric acid thus:



or dimeta phosphoric acid to distinguish it from the mono-meta ($\text{H}_3\text{P}\overset{\vee}{\text{O}}_4$) mentioned above.

3. *Hypo* (from the Greek under), denotes the position of a compound. Thus, the acid containing less oxygen than chlorous acid is called hypochlorous acid, viz.: HClO .

4. *Hyper* (from the Greek, over), refers to the converse of the prefix hypo. Thus, hypersulphurous acid (commonly called hyposulphuric acid) denotes an acid containing more acid than sulphurous acid.

Finally it should be remembered that there are other acids than those in which oxygen is found, these are usually distinguished by the prefixes.

5. *Sulph* or *Sulpho*, *Hydr* or *Hydro*. The composition of acids formed by the combination of sulphur or hydrogen (without oxygen) with other elements is expressed by the foregoing prefixes, the terminals *ous* and *ic* being also employed, in the case of the sulphur compounds, to indicate the proportions of sulphur relatively present. In the case of hydrogen such terminations are not needed, inasmuch as only one acid is formed by the union of an element with hydrogen.

Fortunately these irregular compounds are of comparatively little importance to the readers of this work, for whom the naming of ternary compounds may be condensed as follows:

1. *The names of all inorganic, ternary compounds end either in ate, or ite.*

2. *All bases are called hydrates, and their positive elements take the termination ous, or ic according to their valence.*

3. *All acids and salts take the terminations ate or ite, according to*

the valence of their negative element—other than oxygen. The methods of estimating this valence are given on page 128.

What is said above applies only to the naming of inorganic chemical compounds, for the nomenclature of organic chemistry is somewhat different from that which we have been considering. Not that organic compounds differ in chemical affinity from inorganic. The same power of chemism binds the atoms together in either case; and it is only as a matter of convenience that this division into organic and inorganic compounds is adopted. The number of the compounds containing carbon is so greatly in excess of all others known to chemists, that they are generally discussed by themselves. Roughly speaking, then, all the compounds containing carbon may be grouped together under the head of organic chemistry and all others under inorganic chemistry. The inorganic salts normally found in the human body are comparatively few in number, and as a rule pass through the system unchanged. The organic on the other hand are legion in number, and suffer the most varied metamorphoses. The more important of these we shall endeavor to take up in the present section, beginning with

THE INORGANIC CONSTITUENTS OF THE HUMAN BODY.

1. Water.
2. Gases: Oxygen, Hydrogen, Nitrogen, Carbon Dioxide, Marsh Gas, Sulphuretted Hydrogen.
3. Salts: Sodium Chloride, Potassium Chloride, Ammonium Chloride, Calcium Fluoride, Sodium Carbonate, Potassium Carbonate, Ammonium Carbonate, Calcium Carbonate, Magnesium Carbonate, Sodium Phosphate, Potassium Phosphate, Calcium Phosphate, Magnesium Phosphate, Ammonio-Magnesium Phosphate, Ammonio-Sodium Phosphate, Nitrate of Ammonia, Ammonium Sulphate, Alkaline Sulphates, Calcium Sulphate.
4. Free Acids: Hydrochloric Acid, Sulphuric Acid.
5. Silicon, Iron, Manganese, Copper, Lead.

The exact part each of these acts in the body is not yet definitely known; in fact it is not yet even known in what combinations the members of the last group are found in the body. But it is known wherever cell formation takes place in the body there certain of the inorganic salts are necessary. Calcium phosphate, for instance, is not only necessary for the development of bone but of all albuminoid tissues. Sodium chloride is always found where cell activity is great, and the exchange of inorganic gases has already been alluded to under the subject of respiration. As far as possible we shall endeavor to give under each salt the ways in which it enters and leaves the body, and the part

it serves while there. In quantity, the most important of all these inorganic compounds is

WATER.

Long ago the human body was defined as forty-five pounds of solid matter diffused through five and one-half pails of water. This is not exact, for careful estimations show that fifty-nine per cent of the whole body is water. As appears in the annexed table its percentage varies from two parts in a thousand in the enamel of the teeth to 995 in the perspiration.

PARTS IN A THOUSAND OF WATER AND SOLIDS. (*Besanez.*)

	Water.	Solids.		Water.	Solids.
Enamel of the teeth.....	2	998	Nerves	780	220
Teeth.....	100	900	Blood.....	791	209
Bones.....	220	780	Cellular tissue.....	796	204
Fat.....	299	701	Kidneys.....	827	173
Elastic tissue.....	496	504	Bile.....	864	136
Cartilage.....	550	450	Milk.....	891	109
Liver.....	693	307	Chyle.....	928	72
Spinal cord.....	667	333	Mucus.....	934	66
Skin.....	720	280	Lymph.....	983	17
Brain.....	750	250	Spinal fluid.....	988	12
Muscles.....	757	243	Saliva.....	995	5
Spleen.....	758	242	Sweat.....	998	2

If therefore all the water could be extracted from a body it would weigh less than half of what it does during life, and if kept from moisture it might be preserved almost indefinitely. Buckland in his "Curiosities of Natural History" tells the following story:

"In the College of Surgeons is the dried body of a poor boy, that was found bricked up in a vault in a London church. This boy was about twelve years of age. He was found erect, with his clothes on, in a vault underneath St. Botolph's, Aldgate, old church, in the year 1742; and is supposed to have been shut in during the plague in London, in 1665, as the vault had not been opened since that period till it was pulled down. This body weighs only eighteen pounds."

As might be expected, the proportion of water in the tissues of the new born is larger than in the adult, both as a whole and in their individual parts. Curiously enough too, there are certain organs in the body whose percentage of water is larger than the fluids circulating through them. (See kidneys and blood.) Hence the water in these organs must play another part than it does in the fluids where it performs chiefly the part of a solvent, and their consistence depends less on their water than on the substances which it holds in solution; so that we may find fluids in the body thicker than blood which will yet show a larger proportion of water. The water in the solid parts of the body is held there

very much after the same fashion as is water of crystallization in the mineral kingdom, and comes mainly from drink and food. All observers are agreed that in addition, a small quantity of water is formed in the tissues undoubtedly partly from the excess of oxygen taken into lungs over what is necessary to form carbonic dioxide (10 to 25 per cent.), and also from the oxidation of the hydrogen contained in the tissues whose end products are water and carbonic acid. Fats are very rich in water; and as they disappear during lack of food it is possible that we find here an explanation of the source from which hibernating animals obtain their fluids during their protracted sleep. About half of the water excreted from the body passes off by the kidneys, the remainder by the skin and in the expired air. Water is one of the necessities of life for the following reasons, viz.:

1. It is the general solvent of the substances contained in the tissues of the body, and hence necessary for their proper diffusion.
2. Water is imbibed by all the tissues; and to this fact is due their elasticity, their expansibility, their transparency, and permeability to electrical currents.
3. The watery vapor arising from the lungs and skin continually passes from the body until the surrounding atmosphere becomes saturated with moisture. In this way the evaporation of water cools the body, and, in a measure, acts as a heat regulator.

Thirst is the cry of the system for fluids to supply the lack of those that are continually passing away by the lungs, skin and kidneys. (See page 84.) Whatever increases excretion, increases thirst especially anything that removes rapidly the watery vapor from the surface of the lungs, as speaking, singing and blowing of musical instruments. Anger also increases thirst, and any highly spiced or salty food does the same. This arises from such food requiring much fluid for its solution, which quickly uses up the saliva and gastric juice; and also because it acts as indirect stimulus to the upper part of the digestive tract, and lastly because their excretion from the blood can only take place in combination with much water. The same reason applies to many drinks such as tea, coffee, brandy, etc. The warmer and dryer the air, the greater the need of fluids, hence the greater use of drinks in the tropics than in Northern climates. And whenever there is much perspiration there is pressing need to drink much water to supply that taken away by evaporation. The Swansea copper-furnace man is exposed to great changes of temperature; a thermometer at his chest denotes 120 degrees, one on his back 60 degrees or 70 degrees. After two hours exposure to the scorching blaze, he retires to the open air to cool himself, and to drink. His drink is generally water, two or three gallons in twelve hours, but then he perspires six hundred gallons in the year before his furnace. Yet Dr.

Williams reports that he is "a merry fellow, who lives to a good old age, as hale, florid, and corpulent as his neighbors." When steam vessels are voyaging in the tropics, the heat of the engine-room combined with the temperature of the air is so overpowering that the stokers and others have free access to an unlimited supply of iced water in which oatmeal has been sprinkled; the drinkers say this oatmeal prevents so much water disturbing the stomach, and experience in these matters generally leads to right conclusions. If the men had not this water they would not be able to withstand the evaporation, and the heat would kill them. The human skin is in itself a great absorber of water, and sailors exposed in the open sea without fresh water, find their thirst relieved by application to their bodies of cloths wet with salt water, whereas if they drank the same their suffering would be unbearable.

Thirst also attends the ascent of high mountains, being there due to both an increase of perspiration and the dryness of the air. Thirst is more pressing in its demands than the lack of solid food; for it expresses a demand of the system for fluids that is attended by a most distressing dryness of the mouth and pharynx, which, however, can be relieved by injections into the veins or rectum equally well as by drinking, and even copious baths may accomplish it to some extent. Dilute acids are valuable in relieving thirst. Thirst, then, is a nervous phenomenon produced by deficiency of water in the blood, and also artificially by section of the vagi nerves or paralysis of the lower part of the œsophagus whereby the saliva no longer reaches the stomach but is vomited after a time. The chemistry of water in reference to digestion will later be discussed under its appropriate head; but before passing to a consideration of the gaseous constituents of the human body this would be as favorable a place as any to consider the subject in general of

SPECIFIC GRAVITY.

What do we understand by specific gravity? Simply, the relative weight of equal volumes of two different substances. And since it is necessary to agree upon one substance as a uniform standard, with which all other (solid or liquid) bodies can be compared, *pure water* has been chosen as such standard; and no matter what the actual value of the other substance may be, the weight of this volume is always calculated or determined in figures which refer to *one part, or to one thousand parts of water*. Supposing a certain measure full of water should hold exactly 1,000 grains of the latter, and the same measure, when afterwards filled with another liquid, should hold exactly 2,000 grains of the latter liquid, then its specific gravity would be double that of water. Supposing the same measure should only hold 500 grains of another liquid, the specific gravity of the latter would then be only one-half of that of water. The

specific gravity therefore, is a figure which expresses *how much greater or how much smaller* is the weight of a given volume of a substance compared with the same volume of water. The arithmetical operation by which it is determined *how much greater or how much smaller* one volume is than another, is performed by division. If we want to know how much larger 12 is than 4, we divide 12 by 4 and obtain as answer, 3. That is, 12 is three times as large as 4. We, therefore, have the rule: *To find the specific gravity, divide the weight of a given volume of a substance (as ascertained by weighing it in air) by the weight of the same volume of water.* It is not an easy matter, or at least not always convenient to ascertain, experimentally, the exact weight of an equal volume of water. It may be accomplished approximately, providing the substance is not soluble in water, by such devices as the following:

1. Immerse the body in a measured volume of pure water (at the proper temperature) contained in an accurately graduated cylinder or burette, and observe the increase of volume. The weight of this increase, which may be easily calculated, is the figure sought.

2. Into a vessel provided with a lateral outlet, pour water until the latter begins to flow from the outlet. When all that can flow or can drip out has passed, place a weighed beaker under the outlet, and cautiously and slowly immerse the solid in the water, when it will cause a volume of water equal to its own, to flow into the beaker in which it then may be weighed.

Neither of these methods, however, furnishes as accurate results as the indirect method derived from the physical law (first observed by Archimedes), viz.:

“A body immersed in a liquid loses as much weight as its own bulk of that liquid weighs.”

Therefore, if we weigh the body while immersed in water, it will weigh less by precisely the weight of its own volume of water. Deducting, therefore, the weight of the body when immersed, from its weight in air, we find the weight of an equal volume of water. Or, to state it inversely, the weight of an equal volume of water is found for a solid body, by deducting its weight when immersed in water from its weight in air. Or, in still other words, the weight of an equal volume of water is the same thing as the loss of weight of the substance in water. Let us now substitute this latter expression (or value) in the rule above quoted, and the rule becomes:

To find the specific gravity—

3. *Divide the weight of the given volume of a substance (as ascertained by its weight in air) by the loss of weight in water (as ascertained by weighing it under water and deducting this weight from the former.)*

The rule may be extended thus:

1. Bodies which float at any level in water displace their own weight and their own bulk of water.

2. Bodies which float on the surface of water displace their own weight and less than their own volume of water.

3. Bodies which sink in water displace their own volume but less their own weight of water.

Liquids require only that they should be weighed in a vessel of convenient size and known weight, and compared with the weight of the contents of the same vessel filled with water. For this purpose what is known as a specific-gravity bottle is used, or one which contains exactly 1,000 grains of water at ordinary temperatures.

Gases are usually compared with an equal bulk of air to obtain their specific gravity. The theory of this is the same as that used for obtaining the specific gravity of liquids previously described; but its practical application is not a little difficult as it requires glass globes so made that they can be weighed just full of air, then emptied by an air pump of all air, and accurately weighed, and then filled with the pure gas whose specific gravity is desired. The weight of the gas thus obtained, divided by the weight of the same bulk of air will give the specific gravity of the gas.

THE GASEOUS CONSTITUENTS

of the human body are oxygen, hydrogen, nitrogen, carbonic dioxide, marsh gas, and sulphuretted hydrogen. The physical properties of the first three of these may be found on page 111.

1. *Oxygen*, as already been said, on page 65, enters the organism with the inspired air and is quickly absorbed by the blood, not chiefly from atmospheric pressure but entering into feeble chemical combination. Exactly what this combination is, will be discussed more fully under the subject of the chemistry of the blood corpuscles; for Berzelius long ago observed that the blood serum without the corpuscles, absorbs but very little oxygen. (See Hæmoglobin.)

Excretion: But a portion of the oxygen taken into the body escapes with the expired air, the rest enters into various chemical combinations and, as a rule, at last leaves the body as water or carbonic acid gas. A full description of all the steps in these combinations would be that of the functions of all of the parts of the body, and belong more properly to physiology than the present work.

One of the more important functions of the oxygen taken into the blood is the heat produced by its combination with, or combustion of the tissues no longer of use to the body. Recent experiments show that this is under the control of the sympathetic nervous system (see page 59), without whose regulation the body would be constantly exposed to alternation of heat and chill, such as accompanies disease. Hence, a man in

health, and neither gaining nor losing flesh, is *incessantly* oxidating and wasting away, and *periodically* making good the loss. "So that if he could be confined in the scale-pan of a delicate spring balance, like that used for weighing letters, in his average condition, the scale-pan would descend at every meal and ascend in the intervals, oscillating to equal distances on each side of the average position, which would never be maintained for longer than a few minutes. There is, therefore, no such thing as a stationary condition of the weight of the body; and what we call such, is simply a condition of variation within narrow limits—a condition in which the gains and losses of the numerous daily transactions of the economy balance one another." Death puts a stop to this process of combustion, so that the gradual cooling of the body is one of the surest proofs of death. (See page 95.) Where and how the oxidation of the various tissues takes place, we shall endeavor to show in the appropriate places; particularly the rapid oxidation (or putrefaction) which takes place after death, when, as Huxley says, the forces of the inorganic world no longer remain the servants but become the masters of the body; and "oxygen no longer the sweeper of the living organism becomes the lord of the dead body."

2. *Hydrogen* described on page 110 in its free or uncombined condition is found only in very small quantities in the body; though as may be seen from the table on page 113 it constitutes a large proportion of the same in its combinations, chiefly water, of which it makes up one ninth part by weight. Free hydrogen is found to a very small amount in expired air; and in larger quantity in the gaseous contents of the intestines and stomach, especially after a milk diet. The origin of the free hydrogen in the body has not been ascertained with certainty; but it is well settled, that it is a product of chemical decomposition analogous to butyric acid fermentation. It escapes from the intestines, and it is one of the gases given off with the perspiration.

3. *Nitrogen* has already been described on page 116 and, as the chief constituent of the atmosphere, it finds its way where ever that does in the body; hence we find it in the lungs, blood and among the gases of the intestines. In the lungs and air passages nitrogen is found in the gaseous condition. In the blood it is absorbed, but whether this is done through the blood serum or the corpuscles can not as yet be decided. The nitrogen found in the stomach comes in part from air swallowed with the food; but, as more is found in the large than in the small intestines, it must find its way there either, from the blood or from chemical decomposition. It is mainly excreted from the kidneys, although slight excretion of nitrogen takes place from the skin. The physiology of nitrogen is, as yet, entirely unknown, for it seems to act only a negative part in the economy.

(4) CARBONIC ANHYDRIDE.

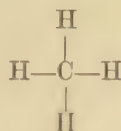
Synonyms: Carbonic acid or Carbonic acid gas, Carbonic Dioxide, Mephitic air, Hepatic air, Choke damp, ^{iv} Fixed air, Gas sylvestre. Formula: CO_2 or graphically $\text{O}=\text{C}=\text{O}$. Molecular weight, 44.

100 cubic inches weighs 47.44 grains.

Carbonic anhydride, as is well-known, is a colorless gas without odor when largely mixed with air, but irritating and pungent when the mixture is over five per cent. The undiluted gas kills instantly by spasm of the glottis, and even when well diluted it has well marked poisonous properties. Carbonic anhydride is twenty-two times heavier than hydrogen; and can be liquefied under sufficient cold and pressure to a colorless liquid, which freezes by its own evaporation to a snow white solid. The pure gas instantly extinguishes fire, but a taper will burn in an atmosphere that is fatal to life. Traces of carbonic anhydride are always found in the atmosphere, and it is also an invariable constituent of the mixture of gases found in the lungs and intestines. Being readily soluble in water (volume for volume) it is always found in the blood and most of the animal fluids. Its presence in the blood, and its danger to the economy when accumulated there, has already been referred to under the subject of the circulation of the blood (page 65) and will be still further discussed in connection with the chemistry of the blood. Experiments seem to show that the presence of phosphate of soda (Na_2HPO_4) in the serum of the blood aids largely in the solution of carbonic dioxide in the same. Carbonic anhydride, it should be remembered, is the final product of many of the retrograde metamorphoses of the tissues of the body; whence reabsorbed by the properties of the blood and excreted chiefly through the lungs (see respiration), though to small extent, also, through the skin and from the intestines. The toxic effects of carbonic anhydride when retained in the blood may be found under the head of poisoning from the vapor from charcoal (see poisons) where it properly belongs.

(5) MARSH GAS.

Synonyms: Methane, Hydrogen, Monocarbide, Light Carburetted Hydrogen. Atomic weight, 16. Formulae CH_4 or Specific gravity 0.563. 100 cubic inches, weight 17.37 grams.



Properties. A colorless transparent gas, next lightest to hydrogen, hence known as light carburetted hydrogen, to distinguish it from other compounds of hydrogen and carbon. Called marsh gas for the reason, that it forms spontaneously in decaying leaves covered with water. It

extinguishes flame, but is itself very combustible, burning with a feeble yellow flame, and is explosive when mixed with oxygen or air. Marsh gas is found in small quantities in the animal organism. According to Regnault traces are found in the expired air and in somewhat larger quantities in the gases of the larger intestine. Chevreul found 5.5 per cent to 11.6 per cent in the colon; and other observers in the intestinal gases of the lower animals, especially in dogs fed upon flesh and sugar or starch. Leguminous diet largely increases its quantity (55.9 per cent), while an exclusively milk diet very greatly decreases it, or causes it to entirely disappear. Bally observed its formation in copious amount in a case of cellular emphysema, but what its origin was in that case is entirely unknown.

(6) SULPHURETTED HYDROGEN.

Synonyms: Hydrogen sulphide, hydrosulphuric acid, sulphhydric acid. *Molecular weight, 34. Formula* H_2S *or* $H-S-H$. *Solid at* 85.5° .

Properties: Sulphuretted hydrogen is a colorless gas with the odor of rotten eggs, very fetid and poisonous when inhaled, one part to 1000 being sufficient to kill dogs. It is a feebly acid gas, and is slightly combustible, and can be made to explode when mixed in the proper proportions with oxygen. Sulphuretted hydrogen is an accidental constituent of the body, although Regnault claimed that he found traces of this gas in the breath. In such cases it comes, probably, not from the lungs, but from the stomach, from whence it also finds its way into the intestines. According to several observers, carbonic and sulphuretted hydrogen are the chief gases arising from the fermentation of a meat diet in the larger intestines. The latter gas passes very rapidly by diffusion into the blood. The origin of this gas in the body is somewhat uncertain; but most likely it comes from the decomposition of albuminoid foods or bile, which contain a comparatively large percentage of sulphur.

Sulphuretted hydrogen concludes the list of the normal gases of the body, and it should be remembered that, to a certain extent, all of these gases are dissolved in the animal fluids.

None of the inorganic constituents during their stay in the body, remain in the same condition; so that Besanez lays it down as a general law, that the inorganic salts enter the body in solution, are taken up by the tissues, and on the breaking down of these tissues return to their fluid condition again. In addition to water (see pages 132-134) we know about thirty of these, viz.:

(2) SODIUM CHLORIDE.

Synonyms: Common Salt, Chloride of Soda, Muriate of Soda. *Formula* $NaCl$. *Molecular weight, 58.50.*

The properties of common salt are too well known to need a description here. (See Antiseptics and Disinfectants.)

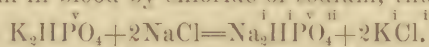
Next to water, salt is the most widely diffused of the inorganic constituents of the body, being found not only in all of the fluids, but also in all of the organs and tissues of the body except the enamel of the teeth. Its presence in the blood serum appears to preserve the integrity of the blood corpuscles; and it is claimed that its percentage in the blood is nearly invariable, without regard to the amount taken in food. The greater part of the salt is contained in the serum, for the corpuscles contain but very little. Chyle, lymph and egg albumen contain considerable quantities, while curiously enough the flesh-juice and the yolk of the egg contain a minimum. Saliva, gastric juice, mucus, pus, and exudates are remarkable for the amount of salt they contain. Salt finds its way into the body in solution, for cooking extracts it from the tissues in which it is contained; so that the quantity of salt taken into the body depends upon the amount of food taken and the salt it contains, either naturally or as it has been added for condiment. Chloride of sodium leaves the body by the urine, feces, nasal and buccal mucus and the perspiration, the largest part leaving the body by the urine, in which, from an adult of normal weight, pass about 170 to 180 grains in the twenty-four hours. Barral's experiments seem to show that the quantity of salt excreted is always less than that taken by the food. About a fifth is lost in this way, and is supposed to undergo decomposition in the body. Possibly the free hydrochloric acid of the gastric juice and the sodium salts found in the bile originate from this decomposition of salt within the body. Recent observations show that salt increases the albuminoid changes of the system and increases the circulation of fluids through the cells. Water containing salt is more quickly absorbed and again excreted through the kidneys, unless the water contains more salt than the blood, when it acts as a laxative and passes off by the bowels. The use of salt with the food assists digestion, especially in the case of the herbivora whose food does not without additional salt supply them with sufficient sodium or chlorine.

(3) POTASSIUM CHLORIDE.

Synonym: Chloride of Potash. *Formula* KCl. *Molecular weight*, 74.5.

Properties: Closely resembles common salt in color, taste and crystallization.

Origin: Thought by some to arise from a decomposition of the phosphate of potassium in blood by chloride of sodium, thus:



Chloride of potassium acts as the complement of chloride of sodium

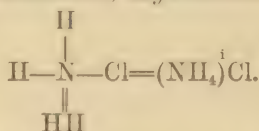
in the body, for where one is found the other as a rule is not; for instance, chloride of potash is the chloride of the muscles, and chloride of sodium that of the blood serum. Like common salt from its ready solubility it always enters the body in solution, and is widely diffused but less important than chloride of sodium. It is chiefly found in the muscles, nerve tissue, blood (corpuscles) and gland secretions, and wherever is cell activity. It is excreted in the urine, saliva and mucus. Potassium chloride enters the body with the food, but Besanecz thinks not as a chloride of potassium but as its phosphate, which subsequently undergoes decomposition. (See page 140.) Curiously enough potassium chloride injected into the circulation produces paralysis of muscular fiber; and muscles and nerves soaked in a solution of the same lose their irritability, while this same salt is one of the ingredients of normal muscle juice. Excretion of potassium chloride takes place, mainly, through the salivary glands, especially during salivation, when six times as much of the potassium salt as of the sodium is thus carried from the body and *vice versa* salivation follows poisoning from potassium salts.

(4) AMMONIUM CHLORIDE.

Synonyms: Chloride of Ammonia, Sal-ammoniac, Hydrochlorate of Ammonia, Muriate of Ammonia.

Formula: $(\text{Am}^1)\text{Cl}^1$, or graphically

Molecular weight=53.4



Properties: It is a white, odorless solid, with a saline, pungent taste, very soluble in water (1 to 3) and slightly so in alcohol. Becomes volatilized without first fusing.

Phys. Chem. The presence of ammonium chloride in the gastric juice of the sheep and dog is well attested, and there is no doubt that it is present to small amounts in the secretions and excretions of the body. Whether it enters the body with the food, or otherwise, or is produced by chemical decomposition within the organism, is not definitely settled, but the probability lies with the latter. It is excreted chiefly by the urine and perspiration. Its use within the body is very slight, if any.

(5) CALCIUM FLUORIDE.

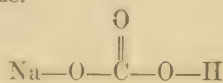
Synonym: Fluoride of lime. Formula, CaF_2 . Molecular weight, 78.

Small quantities of calcium fluoride are found in the bones and teeth, chiefly in the enamel of the latter. It is also found in very minute traces in the milk and brain tissues, but from which of the foods it finds its way into the body, or what its physiological significance is, is, as yet, entirely unknown.

(6 and 7) SODIUM CARBONATES.

(1) Normal carbonate of soda= Na_2CO_3

(2) Bi. or hydrogen Carbonate= NaHCO_3 =



Both of the carbonates of soda (see page 141) are found in considerable quantities in the ash of organic compounds where they are formed, largely from the burning of the carbon compounds; but there is no doubt that they also exist normally in certain of the animal fluids, and in the blood and bone of the herbivora, and, in small amounts, in the blood of the omnivora. During the administration of the alkalis they also appear to a considerable degree in human urine, as well as after the administration of the carbonates, or vegetable acids (citrates, etc.).

There can be but little doubt on theoretical grounds that carbonate of soda exists in the blood, but its isolation has not been successfully accomplished. The carbonates doubtless have very much to do with giving the fluids of the body their alkaline reaction being readily soluble in water. A solution of normal carbonate of soda behaves with carbonic acid gas exactly like the serum of the blood, combining with part of the gas to form a bicarbonate and absorbing the gas set free according to the laws of absorption of gases. The carbonates enter the body partly with the food and drink and partly, are formed within the economy. The free use of fruits, such as strawberries, apples and certain vegetables cause the normal acid urine of man to become alkaline from the citric, malic, and tartaric acids contained in these fruits since the salts of these acids become transformed into carbonates in the system even if they are injected into the bowels or veins.

As has already been said, part of these carbonates are excreted by the urine, a part is also decomposed in the body and the carbonic acid set free by the lungs. The purpose served by their stay in the economy will be further dwelt upon in speaking of the blood, whose power of oxidation depends largely upon the presence of these carbonates in its serum, for it is well known that many organic compounds oxidize more readily in the presence of an alkali; such for instance are gallic and pyrogallie acids. Similarly, hemoglobin, the coloring matter of the blood, when dissolved in an alkaline solution remains unaltered for months, or so long as it is kept from the air, but immediately when oxygen is admitted, it is absorbed and the color of the blood destroyed, and the same is true of many other coloring matters of the body. Very likely the alkalis also assist in the saponification of the fats and their further oxidation, and it is well known that albumen is soluble in alkaline solutions from which it is precipitated by the addition of a weak acid solution.

8. POTASSIUM CARBONATE.

Synonyms: Normal potassium carbonate, carbonate of potash. *Formula,* K_2CO_3 . *Molecular weight,* 99.

Properties: As ordinarily seen is a white, coarse, granular powder,

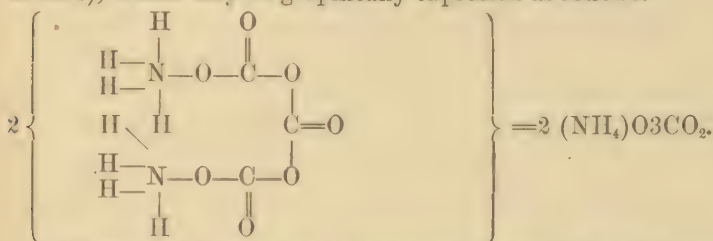
of a nauseous, alkaline taste. It is very soluble in water and deliquescent on exposure to air.

Phys. Chem. Carbonate of potash is found in the blood and urine of the herbivora and in the urine of man when living on a vegetable diet. All that has been said concerning the absorption, excretion and functions of the carbonates of soda apply equally well to the carbonate of potash.

(9 and 10) AMMONIA CARBONATES.

Ammonium is one of the compound radicals of chemistry having the formula (Am) or $(\overset{\text{v}}{\text{N}}\text{H}_4)^1$ and consequently, a valence of one. It is a monad positive radical taking the same place as the positive monad metals, potassium or sodium and hence we have the same carbonates of ammonium as we have of sodium, viz.: (a) The bicarbonate of ammonia. (b) AmHCO_3 . The normal carbonate of ammonia. Am_2CO_3 .

Properties: Normal carbonate of ammonia probably exists only in solution, and what is known as carbonate of ammonia in the shops is a mixture of carbonates of ammonia with the complex formula of $2(\text{H}_4\text{N O}_3\text{CO}_2)$, which may be graphically expressed as follows:



This occurs in whitish, transparent masses, which can be readily volatilized by heat, with a pungent, ammoniacal odor and a sharp, acrid taste. Exposure to the air causes the mass to lose its transparency, becoming white, opaque and crumbly. By giving off ammonia and carbonic dioxide gas it becomes converted into the bicarbonate which is very similar in appearance.

Phys. Chem. Ammonia carbonates are sure to be found among the products of animal decomposition so that the blood in uræmia and cholera contains ammonia carbonate, and in these cases it undoubtedly arises from the decomposition, of urea. Fresh urine contains carbonate of ammonia only during disease, or when the water is long kept in the bladder where the vesical mucus soon brings about decomposition and breaking up of urea by the addition of water into carbonate of ammonia thus:

$\overset{\text{iii}}{\text{NH}_2}-\overset{\text{iv}}{\text{CO}}-\overset{\text{iii}}{\text{NH}_3} + {}_2\text{H}_2\text{O} = (\overset{\text{i}}{\text{NH}_4})_2\overset{\text{iv}}{\text{O}_3}\overset{\text{i}}{\text{CO}}, \text{ or } \overset{\text{i}}{\text{AM}}_2\overset{\text{i}}{\text{CO}_3}$
(ammonium carbonate). In sickness ammonium carbonate has also been observed in the stomach secretions.

(11) AMMONIA NITRATE (NH_4) ONO_3 .

According to Schonbein traces of this salt can be found in the saliva and nasal mucus. The same observer has also found it in the urine.

(12) CALCIUM CARBONATE.

Syn.: Carbonate of lime, Chalk. *Formula* $\text{Ca}^{\text{ii}}\text{CO}_3$; or $\text{Ca} \backslash \text{O} / \text{CO}$. *Molecular weight*, 100.

Properties: Chemically pure calcium carbonate is a white, crystalline substance, which is almost entirely insoluble in water unless containing carbonic acid gas. All vertebrated animals contain chalk in their bones, where it was deposited while the bones were in a cartilaginous condition. It also constitutes the otoliths of the middle ear and is frequently present as a pathological production in the so-called concretions, ossifications and tubercle which has become calcified. The calcium carbonate of the body exist there both in solution and in a solid condition. As carbonic acid is necessary for its solution out of the body, it is probable that it serves the same purpose within it, where, as has already been noted, it is one of the most frequent end products of decomposition. Solid carbonate of lime is deposited both in the amorphous and crystallized condition; concretions are usually unformed.

Calcium carbonate enters the body both as normal carbonate in drinking water and as bicarbonate in food, and it is still in dispute whether or not calcium carbonate may not be formed by the reaction of the alkaline carbonates on the calcium salts in certain conditions of the system. It is very probable that only a part of the calcium carbonate introduced into the organism is directly excreted as such, for experiments outside of the body show that the addition of only a trace of sodium phosphate to a solution of calcium carbonate in carbonic acid water gives a precipitate of phosphate of lime. Such a reaction undoubtedly takes place in the alkaline blood serum. Whether or not calcium carbonate takes part anywhere in any vital function is as yet unsettled, but there is no doubt that the hardness of the bones may be increased by the administration of calcium carbonate and phosphate.

(13) MAGNESIUM CARBONATE.

Formula $\text{Mg}^{\text{ii}}\text{CO}_3$. *Molecular weight*, 84. *Fuses at a red heat*. *Specific gravity*, 1.75.

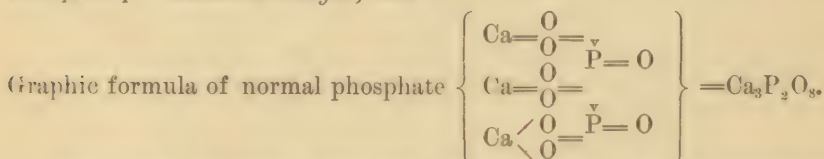
Properties: Carbonate of magnesia is a white solid, not unlike carbonate of lime in appearance, and like it soluble in water containing carbonic acid gas.

Physiology: Magnesium carbonate is found with more or less uniformity accompanying calcium carbonate in the chalky deposits of the

body; occasionally it is also found in the urinary concretions of man. On the whole it is met with only sparingly, although magnesium occurs as a phosphate in all vegetable diet. Its action and place in the economy is just about the same as calcium carbonate just described.

(14) CALCIUM PHOSPHATES.

Synonyms: *Phosphate of lime. Bone earth phosphate. (a) Normal phosphate, $\text{Ca}_3\text{P}_2\text{O}_8$. Molecular weight, 310. (b) Acid phosphate, CaH_2PO_4 . Molecular weight, 236.*



Properties: Calcium phosphate, or bone earth, as it is frequently called, is a white, inodorous, tasteless, insoluble powder which enters the body with the food, in connection with the phosphates of sodium and potassium.

Phys.: It is without exception found in all the tissues and fluids of the body, though only in minute quantities in some. The largest amount is found in the bones and teeth; for these contain about two-thirds of their weight of calcium phosphate, and large percentages also exist in ossifications, incrustations and concretions. In fact the outer layers of almost all large urinary calculi are composed of calcium phosphate, which also makes up the bulk of mulberry calculi and most of those formed about a nucleus. All of the organic tissues, such as albumin and its derivatives, when burnt after careful isolation, yield a small amount of ash, which is composed mainly of calcium phosphate; the only exception to this is elastic tissue. By far the larger part of the calcium phosphate in the system exists there as a solid constituent of the bones and teeth, from which it may be isolated as bone earth. It is found in the solid state in the hair, nails, hoofs, etc. But not alone do all the tissues contain this salt, but the animal fluids also. As this salt is insoluble in watery fluids we must seek for an explanation of this in some soluble combination of calcium phosphate. Such a one would be its union with albuminoid matters, in which condition it is freely soluble in water. Moreover, it is known that the certain organic acids as lactic, and certain salts, such as chloride of sodium in aqueous solution, as well as a watery solution of carbonic acid gas, have the power of dissolving somewhat of calcium phosphate. It has already been mentioned that the blood contains carbonic dioxide, chloride of sodium and the alkaline phosphates, and we find in many of the tissues acid phosphates, lactic acid, and other organic acids. Calcium phosphate is found in the

urine of omnivora and carnivora as the acid, or biphosphate, which is of itself soluble in water. Crystallized normal phosphate is a frequent sediment in urine, and its crystals are not unfrequently met with in the pus from carious bones and in certain concretions. The major part of the calcium phosphate enters the body with the food, whether it be animal or vegetable, though a flesh diet is more favorable for this purpose as it is rich in phosphatic salts. Nursing children receive these phosphates from their mother's milk, whose ash shows the presence of phosphates. It is probable that a portion of the phosphates are also formed within the organism (Besanetz). Valentine's investigations show that the newly formed bones are rich in calcium carbonate at first, but that gradually this is changed into calcium phosphate.

Since the feces contain the insoluble constituents of the food, it is evident that no small amount of calcium phosphate is excreted thus. The soluble phosphates are largely excreted by the kidneys, especially in the carnivora, where their solution is assisted by the presence of free acid in the urine.

The importance of the phosphate of lime to the bones is evident; for their peculiar consistence is due to the combination of this phosphate with their gelatinous constituents. (See Bones). The hardness or softness of the bones, then, depends upon whether or not sufficient calcium phosphate is assimilated; and hence it happens that sometimes during pregnancy the urine of the mother will show not even a trace of calcium phosphate, and that a broken bone in a pregnant mother heals with difficulty. The constant appearance of calcium phosphate in all the tissues, and its intimate combination with certain of the tissue constituents, as albumen and the substances from which glue can be made, points strongly to the fact that the salt plays an important part in the formation and development of all the tissues.

SODIUM PHOSPHATES.

(15) Normal Sodium Phosphate, Na_3PO_4 . (16) Hydro-di-sodic phosphate, Na_2HPO_4 . (17) Dihydro-sodic phosphate, NaH_2PO_4 . These phosphates are so nearly alike in appearance and function that for convenience they are grouped together.

The phosphates of soda are all white solids with a saline taste, soluble in water, but without odor. They readily fuse by heat, but are not decomposed. Almost without an exception they are constituents of all the tissues and fluids of the body. In the corpuscles the potassium salts are found; but in the serum the sodium phosphates predominate, the phosphoric acid being in combination with sodium as a base. Careful examinations of the ash of the tissues of herbivora and carnivora show that the ash from the blood of the herbivora is considerably poorer in

alkaline phosphates than that obtained from the blood of the carnivora, and still richer in phosphates is the ash from the blood of animals fed upon grain. These phosphates readily enter the organism, from their ready solubility in water, especially the acid phosphates. The pyrophosphate found in the ash is probably produced there by heat. The hydrodi-sodic phosphate, Na_2HPO_4 , is the one most widely diffused in the economy; and it may be added that, as these phosphates are abstracted from the blood, as a rule they appear in the animal fluids which have an acid reaction—*e. g.*, the urine, muscle-juice and the parenchymatous fluids of certain glands.

There is very little doubt that the phosphoric acid of the system comes from the food; but it is still an unsettled question whether it enters the body as phosphates of the alkalis, or whether these are produced by the decomposition of the phosphates of the alkaline earths. This latter is not at all unlikely, from the presence of the phosphates of potassium and sodium in the muscle-juice and the other tissues, while in the blood we find chloride of sodium and the phosphate of soda.

The excretion of the alkaline phosphates is by preference by the kidneys and intestines. Uric, hippuric and sulphuric acid, the last arising from the sulphur in the albumen, abstract from these alkaline phosphates, part of their base, the remainder of the base remaining united with the phosphoric acid, so what was previously an alkaline salt now acquires a neutral, or acid reaction; such is the origin of the acid phosphate of soda found in the urine. A fluid, rendered acid by phosphoric acid, has the property of dissolving the phosphates of calcium and magnesium, hence we find all of these salts in the urine of omnivorous animals.

There can be but little doubt that the wide-spread distribution of the phosphates of soda in the organism indicate a physiological importance on their part which, however, is not clearly explained; but it is worthy of remark, that wherever in the tissues free acids appear, there the acid phosphates of the alkalis are met with; this is the more remarkable from the fact that the blood contains the basic or neutral alkaline phosphates. The explanation of this is found in the fact that in the tissues are found organic acids which abstract part of the base of these neutral salts, as described above, and convert them into acid salts. In short, it should be remembered that all tissue-forming substances contain the phosphates, which they retain with great persistency; all nutritive fluids contain the alkaline phosphates, and the same are found in all transudates, so that it may safely be said with C. Schmidt that all organs in which, later in life, calcium carbonate is deposited, contain at first a considerable amount of the phosphatic salts. Furthermore, it has been found that nerves preserve their excitability

well, and for a long time by immersion in a few percent solution of phosphoric acid, which may explain its presence in the tissues.

(18). POTASSIUM PHOSPHATES.

The three phosphates of potassium, a normal and two acid, are formed exactly like the analogous salts of sodium; and are so similar in appearance and function that they need no extended description here. As a rule they accompany the sodium phosphates, except in the blood corpuscles and muscle juice, which are especially rich in the potassium phosphates, their acid reaction being due to lactic acid and the acid potassium phosphates. Ranke found that the injection of acid potassium phosphate into the capillaries of a muscle diminished its excitability, and at the same time produced increased susceptibility of the peripheral nervous system—phenomena well known to all as accompanying great fatigue.

(19). MAGNESIUM PHOSPHATE.

Formula: $Mg_3P_2O_8$. *Molecular weight.* 262. (20) *Acid phosphate,* $MgH_2P_2O_8$.

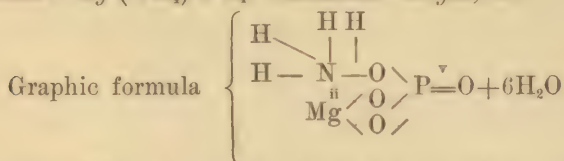
Properties: May be obtained from wheat and other grain, as small, colorless crystals, which are soluble in about 1,000 parts of cold water. Magnesium phosphate, like the corresponding salt of lime, is found in almost all the tissues and fluids of the body, but usually in much smaller quantities. The chief exceptions to this rule are the muscle juice and the fluid contained in the thymus gland, where the magnesium phosphates greatly exceed the calcium phosphate. Magnesium phosphate also is found with the phosphate of lime in various concretions, where it sometimes exceeds and sometimes entirely excludes the latter salt; but usually the magnesium is in such cases found as the double phosphate of magnesium and ammonia, soon to be considered. The bones of the herbivora contain more magnesium phosphate than those of the carnivora.

An acid phosphate $MgH_2P_2O_8$ is often found as a sediment in urine, and also in various concretions, in pus, pathological cysts, and in the watery effusions of the pleura and pericardium, and on the surface of carious bones. Like the phosphate of lime the phosphate of magnesium occurs in the body both in solution and in the fixed or solid form, the latter being found in the bones, teeth and concretions. Its solution takes place in most of the animal fluids, and is assisted by the presence of calcium phosphate; its solubility in urine is due to the presence of free acid in the same.

The excretion of magnesium phosphate closely resembles that of calcium phosphate, taking place mainly through the kidneys and intestines.

(21). AMMONIO-MAGNESIUM PHOSPHATE.

Formula: $Mg^{II} (NH_4^I) PO_4$. *Molecular weight, 137.*



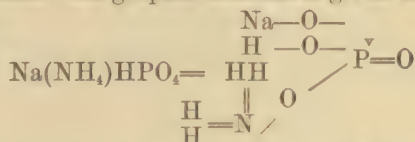
Properties: This salt may be obtained in a white crystalline form by precipitation, and is slightly soluble in pure water, but is nearly insoluble in ammoniacal and saline fluids.

This ammonio-magnesium phosphate is not a normal constituent of the body, and yet is very frequently found there. Its most frequent occurrence is as a sediment in urine, and almost all urine will deposit when it begins to decompose. The same is true of all decomposing discharges from the body, and hence this salt is found in the excrement whenever decomposition begins in the u. This is the reason these crystals are found in the passages of typhoid fever, and whenever there is ulceration of the intestine; the crystals sometimes being found in the infiltrated mesenteric glands themselves. The urine of pregnant women not infrequently forms on its surface a film containing numerous crystals of this double salt. In vesical calculi and still more frequently in the renal concretions of man and mammals we find this salt usually accompanied with calcium phosphate, sometimes also with uric acid, urates and calcium oxalate.

This double phosphate of ammonia and magnesia is formed within the body whenever from any cause ammonia comes in contact with normal magnesium phosphate; as for instance in the urine when urea breaks up into ammonia and water (See page 143); the urine in consequence becomes alkaline instead of acid, and a combination of the free ammonia with the magnesium phosphate takes place, whereby it is precipitated as the double phosphate; and a similar reaction takes place whenever animal matter decomposes, for it always at that time sets free ammonia. It can hardly be said that this double phosphate has any physiological importance other than its pathology, and the quantity formed in this way is generally small. The alkaline reaction of freshly passed urine with its sediment of this salt, often mistaken for pus, indicates some lesion of the bladder or spinal chord, unless the person is drinking at the time some of the alkaline mineral waters, such as Vichy, which will produce a similar deposit, and occasionally even a vesical calculus.

There is a sodio-magnesium phosphate, or, more properly, an acid, or bi-sodio-magnesium phosphate, which is also an abnormal

product of the organism, but of less frequent occurrence than that just described. Like that, it is deposited from putrid urine, or that in which the urea is beginning to decompose. Its crystals are columnar and slightly soluble in water and acids, and are changed by heat into metaphosphate of sodium. Its graphic formula is given below:



ALKALINE SULPHATES.

(22-23). Normal Sulphates, $\text{Na}_2\text{SO}_4 + \text{K}_2\text{SO}_4$.

(24-25). Acid Sulphates, KHSO_4 and NaHSO_4 .

Properties: The alkaline sulphates closely resemble each other in appearance and properties being crystalline, soluble and generally having a bitter, disagreeable taste.

Physiology: Small quantities of the alkaline sulphates appear in most of the animal fluids and tissues except milk, bile and gastric juice, where they are entirely absent. Nevertheless, these will give by incineration these sulphates in their ash, for all organic substances which contain sulphur produce sulphuric acid by burning, and this displaces the carbonic acid of the various carbonates.

The presence of the soluble sulphates in the urine can easily be proved by the use of any of the ordinary reagents. It appears there without the destruction of organic matter, so that, with great probability, the alkaline sulphates exist preformed in the blood. The researches of Bibra show the alkaline sulphates present to a considerable extent in the bones of fishes and reptiles, but we have no reason to suspect that they exist in the body in other form than in solution. Besanez is decidedly of the opinion that the alkaline sulphates are not entirely taken into the body from without; but that they are in part produced in the system by the oxidation of the constituents of the body which contain sulphur, thus forming sulphuric acid; and this combines with the alkalies and in this way produces the alkaline sulphates, so that, at least in small part, the alkaline sulphates are the products of retrograde metamorphosis. Their excretion naturally takes place mainly through the urine. In health the average amount excreted is from twenty-five to thirty-five grains in the twenty-four hours, and this amount can be increased not only by the introduction of sulphates into the body, but also by the use of any compound containing oxidizable sulphur, or even sulphur itself. The free use of meat of any kind also increases the excretion of these sulphates, probably from the sulphur in the albuminoids of the flesh. If this sul-

phur is oxidized to sulphuric acid, it might also indirectly explain the increased acidity of the urine known to be produced in this way. Only when taken in large doses are the alkaline sulphates excreted by the intestines, for smaller amounts are re-absorbed from the alimentary canal. It is also interesting to remember that part of the alkaline sulphates remaining in the intestines, may be reduced to the form of the sulphides as proven by the greenish black passages of those taking mineral water containing both carbonate of iron and the alkaline sulphates, the color being due to the formation of the sulphide of iron.

(26.) CALCIUM SULPHATE.

Formula: $\overset{ii}{Ca} SO_4$. *Molecular weight, 138.*

Properties: When crystallized it contains six molecules of water and is insoluble in alcohol and dilute acids. When calcined it becomes a floury white powder, which eagerly unites with water and is known as Plaster of Paris.

Physiology: It is doubtful whether sulphate of lime is a normal constituent of the higher animals. It has been found in the blood, pancreatic juice, excrements and rachitic bones, but only when these have been subjected to previous decomposition. It is quite frequently met with in the lower animals.

(27.) HYDROCHLORIC ACID (HCl.)

Properties: Hydrogen chloride is really a colorless gas about one-fourth heavier than the air (sp. gr. 1.257), but is so readily soluble in water, which absorbs at 40° F. 480 times its volume, that this aqueous solution is what is usually understood when hydrochloric acid is spoken of. Heat again expels the gas from its solution, which fumes in moist air or that in which there is free ammonia vapor. (See Poisons.)

Physiology: There is no doubt that free hydrochloric acid is found in the gastric juice of man and the mammals; and is also found in connection with free sulphuric acid in the saliva of certain snails and other animals. The quantity daily secreted by an adult, according to C. Schmidt is about fifty grains. It is quite definitely determined that hydrochloric acid is produced in the system from the metallic chlorides, especially the chloride of sodium, but just how it is done has not yet been explained.

None of the free hydrochloric acid of the gastric juice is excreted as such. It is quite probable that the hydrochloric acid in its formation from common salt (NaCl) sets free sodium (Na) which reappears in the alkaline bile and pancreatic secretions, which the free hydrochloric acid of the gastric juice meets on its passage downwards with the food and is again neutralized. There is no reason to doubt that free hydro-

chloric acid plays an important part in the chemistry of digestion. This is proven by the constant presence of the acid in the gastric fluids; and the fact that a watery solution of gastric mucous membrane will not perform artificial digestion until a few drops of acid have been added. Hydrochloric acid also increases the power of the gastric juice to dissolve the constituents of the food, especially the phosphates.

(29). SULPHURIC ACID, H_2SO_4 .

Properties: Strong sulphuric acid has a syrupy appearance and fumes in moist air. If pure it has neither color nor odor; sp. gr. 1836. It is one of the strongest of the corrosive poisons. For its action, see poisons.

Physiology: Free sulphuric acid is found in the secretion of certain snails and gasteropods, but up to the present time has not been established as a normal constituent of the human body.

(30). SILICON, IRON, MANGANESE AND COPPER

are here grouped together because they are all known to be constituents of the body, but their combinations are as yet not certainly known.

SILICON.

Traces of this can be discovered in the ash of blood, bile, urine and eggs, but the largest quantity of it is found in ash of hairs, feathers and excrement, though in the latter case the silicon may come from sand accidentally taken into the system. As has already been said, the exact combination in which silicon occurs in the body is not yet definitely known. Ladenburg's discoveries of the organic silicon combinations—silicon alcohol, silicon propionic acid, etc., has perhaps given us the combinations which yield silicon ash on burning.

The silicon found in the body naturally comes from without, being in the first instance, taken with food and drink; and as might be expected the kind of food has much to do with the appearance of the hair and feathers in the lower animals; the feathers of birds for instance which are fed upon corn, which is rich in silicon, being much finer than those fed upon a different diet. We have as yet no accurate observations on the method of excretion of the silicon compounds, whether by the urine or elsewhere. The urine of the higher mammals contains a trace of silicon, but whether this represents the entire amount of silicon excreted has not yet been satisfactorily settled. It is probable that the silicon in the excrements is present there from food which has not been properly assimilated. What is the physiological import of the traces of silicon found in the higher mammals has also not yet been settled definitely; but it certainly has about the same relation to feathers that calcium has to bone tissue.

IRON.

Iron is par excellence the element of the blood, and especially of the corpuscles, as is proven by the red color of the ash from blood. Blood serum gives a colorless ash, so it is now pretty definitely settled that the iron of the blood is limited to the hæmoglobin, which see. So noticeable is the amount of iron contained in the blood that the ash of any tissue in which blood freely circulates, will give an ash also showing the iron color. Iron is also found in the gastric juice, hair, feathers, and in the chyle, lymph, bile, gall stones and the black pigment of the eyes, and finally the milk and urine contain minute traces. The most noticeable quantity of iron is in the blood (0.057 to 100.), so that it would be possible to realize Parmentier's romantic idea of making iron mementoes from the metal extracted from the blood after death; provided they did not exceed about fifty grains in weight, which careful estimations give as the amount of the iron contained in the blood of a man of average weight. The entire amount of the iron in the blood is contained in the hæmoglobin, as has already been noted, and this will be discussed more in detail later. The iron in the gastric juice is there probably as a chloride, though it may also be united with lactic and other organic acids. In the spleen iron is found partly as a constituent of an albuminoid compound and partly as lactate, acetate and phosphate of iron.

Iron reaches the body by way of food and drink, and these contain so much iron that it always appears in the excrement. In what form iron is really excreted from the organism has not been fully investigated. Harley succeeded in proving that it is in part excreted by the urine, and Young thinks he has done the same in reference to the coloring matter of the bile, which he thinks is manufactured from the blood corpuscles and consequently contain iron. For the physiological uses of iron see hæmoglobin.

Manganese is in nature always found accompanying iron, hence we need not be surprised to find traces of this metal in the body in connection with iron, viz.: in the blood, bile, hair and gall stones, and urinary calculi. Its relation to the organism is as yet entirely unknown, both as to its combinations and as to any part that it may bear in the functions of life.

COPPER.

Copper has been found repeatedly in the blood, bile, liver, milk, and gall stones of man in small quantities, but apparently there as an accidental constituent, and without any physiological importance. There is very little doubt but that the traces of copper that have been found in these organs come from food that has been cooked in poorly tinned cop-

per vessels; and its appearance in the liver is interesting as showing the tendency that metals have when taken into the body to collect in the liver and remaining there for a long time. It is a matter of some physiological interest to know that the blood of some of the lower animals and shell fish normally contain copper to a considerable per cent, and that the red pigment in the wing feathers of certain birds contains nearly six per cent of copper.

LEAD.

Traces of lead are occasionally found in the blood, the liver, and other organs of man; but like copper are accidental, and from similar sources, especially water, which is very prone to contain traces of lead from the pipes through which it is conveyed. (See Lead Poisoning.)

These complete the list of the inorganic constituents of the body and brings us to those to which the name of organic has been given. See page 900. No less than eighty of these are known, and to these doubtless many more will be added.

ORGANIC PROXIMATE PRINCIPLES.

- | | |
|-----------------------|------------------------------|
| 1. Benzoic acid. | 27. Ammon urate. |
| 2. Ceratinic acid. | 28. Biliprasin. |
| 3. Cholaic acid. | 29. Bilihumin. |
| 4. Choloidinic acid. | 30. Bilirubin. |
| 5. Cyanuric acid. | 31. Bilifuscin. |
| 6. Elaidinic acid. | 32. Biliverdin. |
| 7. Glycocholic acid. | 33. Calcic lactate. |
| 8. Hippuric acid. | 34. Casein. |
| 9. Hyocholalic acid. | 35. Cerebrin. |
| 10. Hyocholic acid. | 36. Cetin. |
| 11. Lactic acid. | 37. Chitin. |
| 12. Leucinic acid. | 38. Cholesterin. |
| 13. Mosaic acid. | 39. Chondrogen. |
| 14. Mucosin. | 40. Dyslysin. |
| 15. Palmitic acid. | 41. Elaidin. |
| 16. Medullic acid. | 42. Blood fibrin. |
| 17. Paralactic acid. | 43. Elastin. |
| 18. Stearin. | 44. Fibroin. |
| 19. Taurocholic acid. | 45. Globulin. |
| 20. Uric acid. | 46. Glycocol. |
| 21. Æthal. | 47. Glycogen. |
| 22. Albumen. | 48. Glycero-phosphoric acid. |
| 23. Allantoin. | 49. Guanin. |
| 24. Alkalialbuminate. | 50. Hæmatin. |
| 25. Alloxantin. | 51. Hæmoglobin. |
| 26. Alloxan. | 52. Hypoxanthin. |

- | | |
|-------------------------|--------------------|
| 53. Inosite. | 67. Pancreatin. |
| 54. Ceratin. | 68. Pepsin. |
| 55. Potassium urate. | 69. Sugar of milk. |
| 56. Creatin. | 70. Stearin. |
| 57. Ceratine. | 71. Paraglobulin. |
| 58. Creatinin. | 72. Syntonin. |
| 59. Leucine. | 73. Sarcosine. |
| 60. Melanin. | 74. Ossein. |
| 61. Murexid. | 75. Tyrosin. |
| 62. Sodie glycocholate. | 76. Taurin. |
| 63. Sodie taurocholate. | 77. Urea. |
| 64. Sodie urate. | 78. Xanthin. |
| 65. Olein. | 79. Lecithin. |
| 66. Palmatin. | 80. Paralactate. |

These organic constituents might be taken up one by one as has been done with the inorganic, but the better way, as it seems to the writer, is to consider them in groups, or in connection with the various tissues in which they are found. Various groupings of these constituents of the body have been suggested, and one of the most convenient of these is the one proposed by Dr. J. C. Dalton, viz.: into three classes of proximate principles. But first let us clearly understand what a proximate principle is, and for this purpose we quote his own language :

“A proximate principle is any substance, whether simple or compound, which exists under its own form in the animal fluids, or solids, and which can be extracted from them by means which do not destroy its chemical properties.”

According to this definition calcium phosphate, and all of the inorganic compounds thus far discussed, are proximate principles, for each may be extracted in its own form from some one or more of the animal fluids or solids. The constituent parts of these salts, *e. g.*, phosphorous or calcium, in the compound just mentioned, are not proximate principles for the reason that they can only be obtained by the decomposition of the proximate principle. Proximate principles, then, bear about the same relation to a body and its chemical elements that brick, mortar and lumber do to a house. None of these are the chemical elements from which all things are constructed, and into which the bricks, etc., themselves can be resolved ; and yet as we think of the house being built of these instead of their chemical elements so we construct in thought the human body from its proximate principles. These proximate principles as has already been said may be divided into three classes, viz.:

CLASS I. *Inorganic. Crystallizable and of definite chemical composition.*

CLASS II. *Crystallizable substances of organic origin, such as sugar, gum, etc.*

CLASS III. *Organic substances which are not crystallizable, and are but loosely held together by chemism.*

Class I. has already been fully discussed, beginning with water and ending with the sulphates (pp. 132-152). Classes II. and III. perhaps can be best studied by a consideration of the various tissues and fluids in which they are found.

CERATINE, ETC.

Beginning with the outside of the body we find it covered with the integument already described (See page 90) as consisting of epithelium, connective tissue, vessel and gland structure and nerves, etc. Epithelial scales (the epidermis), horn, nails and feathers chemically consists largely of a substance to which the name of ceratine has been given for the reason that it is easily prepared from horn, which leaves it behind after successive washings with boiling water, alcohol, ether, dilute muriatic acid, and water again. The residue thus obtained is insoluble in alcohol and ether, and only swells up but does not dissolve in hot water. When burned it gives off the odor of burnt feathers; heated with water in a closed tube it finally dissolves and gives off sulphuretted hydrogen gas. Nitric acid first colors it yellow, and if long continued converts it into oxalic acid; hydrochloric acid stains it purple, and by long continuance, brown, while warm concentrated sulphuric acid changes it into a slimy mass, in which under the microscope cells are clearly visible. Concentrated caustic potash has a similar effect, and if hydrochloric acid is added to the gelatinous mass the disagreeable odor of sulphuretted hydrogen is evolved. It is doubtful whether an absolutely pure ceratine has yet been prepared; for there are slight chemical differences observed in that obtained from the various tissues which contain it; *i. e.*, the ceratine obtained from the epidermis is not exactly the same in its proportion of carbon, oxygen, etc., as that from the nails or hoofs, or wool or hair, or feathers or flesh or scales, all of which contain a form of ceratine. The composition of that prepared from the epidermis is given below :

Carbon.....	50.28
Hydrogen.....	6.76
Nitrogen.....	17.21
Oxygen.....	25.01
Sulphur.....	.74
	100.00

All these tissues at first appear to consist of nucleated cells, which later dry down into dry scales, but chemically no difference can be shown between cell membrane, contents or nucleus. Ceratine leaves the

body largely in the form of dried and branny epithelium, or as clippings of hair and nails. Its use in the body is to protect the softer vascular and nervous tissues from mechanical and chemical injury, and as it is a poor conductor of heat, it also regulates the heat of the body as well as transudation and absorption through the skin. (See Perspiration, etc.) *Conchiolin* is the name given by Fremy to the substance remaining undissolved by the action of potash upon muscle sheathing. It is closely allied to, if not identical with ceratine.

TYROSIN, $C_9H_{16}NO_3$.

Tyrosin is one of the products of the oxidation of ceratine and is easily prepared by boiling horn shaving with dilute sulphuric acid, diluting and neutralizing with chalk. Evaporation of the filtrate gives crystals of tyrosin, which may be further purified as necessary. Its pure crystals are needle-like, often arranged in bundles; and are freely soluble in ammonia water and dilute acids, but insoluble in acetic acid, alcohol and ether. Tyrosin has neither odor nor taste, but gives off the odor of burning feathers when set on fire. It may also be prepared from albumen, flesh, fibrin and hair in the same manner as from the nails; and exists in the liver, spleen, kidneys, suprarenal capsules, thyroid and salivary glands in various degenerations of these organs. It is also found in diseased epidermis, thickened nails, and atheromatous cysts. Tyrosin appears in the urine only from degeneration of the liver or kidney. It is a normal constituent of some insects. If cochineal be treated with boiling water, an amount of tyrosin equal to one-third of one per cent of the cochineal is dissolved and crystallizes as the solution cools. Tyrosin represents a low state of organization, and if the substance of any organ be unduly transformed into tyrosin, the functions of such an organ can not long be performed. Consequently, tyrosin in the urine is indicative of changes of a very serious nature in the liver or kidneys, especially the former. All proteids can, by the action of oxidizing agents, yield tyrosin; but it is generally prepared from horn or hair.

LEUCIN, $C_8H_{13}NO_2$

Is similar in its origin to tyrosin and like it, may be artificially produced from horn, according to the method given for manufacturing tyrosin. Their separation is a matter of some difficulty and the details are not of sufficient importance to occupy further space. When pure, leucin crystallizes in thin colorless rhombic plates or fine needle-like crystals. If the solution contains impurities, the leucin takes the form of brownish balls, or disks, which is the form that it is precipitated in from the urine; it is soluble in twenty-seven parts of cold water, and still more so in hot, whose solvent power is increased by foreign matters as seen in the

urine. Cold and hot alcohol are poor solvents, and chloroform and ether entirely fail to dissolve it, but it is freely soluble in both alkalies and dilute acids. Nitrous acid gas converts an acidulated solution of leucin into leucic acid $C_6H_{12}O_3$.

SECRECTIONS OF THE SKIN.

A review of the chemistry of the skin would be imperfect without some description of its secretions, which are chiefly from two kinds of glands, viz.: sudoriferous and sebaceous.

The sebaceous glands of the body are found on those parts which are well covered with hairs, and also on the face and the generative organs. Their function is to furnish a lubricating material for the skin and to keep the hairs soft and pliable by nature's own pomatum, whose composition is as follows:

Albuminoid material.....	358
Fatty matters.....	368
Phosphate of lime.....	200
Carbonate of lime.....	21
Carbonate of magnesia.....	16
Chloride of soda.... }	37
Acetate of soda, etc. }	
	1000

The ceruminous glands of the passage to the ears secrete a waxy substance similar in chemistry, but more consistent, and having a bitter taste and disagreeable odor, possibly to repel insects from finding their way into the opening. The Meibomian glands serve a similar purpose for the edges of the eye-lids, by their sebaceous secretion preventing the tears from continually running over the lids and down the cheeks.

THE PERSPIRATION.

The perspiratory glands of the skin are distributed over its entire surface, but are most numerous on the anterior parts of the body where they are found to the amount of from 500 to 1,000 to the square inch. In the sole of the foot and the palm of the hand they are even more numerous, for here 2,700 to the square inch have been counted, and it has been estimated by careful calculation that the combined length of the perspiratory tubes contained in the body is not less than two miles and a half. Nearly two pounds avoirdupois of fluid exudes through this perspiratory tubing every day, and with heat and exertion, the amount is greatly increased. (See Water, page 132.)

The perspiration is a colorless, watery fluid with a characteristic odor and generally an acid reaction. Its average composition is

Water.....	995.00
Animal matter with lime.....	.10
Soluble sulphates, etc.....	1.05
Soluble chlorides, etc.....	2.40
Acetates, lactates, etc.....	1.45
	1000.00

The chief purpose of the perspiration is to regulate the temperature of the body, although to some extent it serves also to carry off excrementitious matters, especially when for any reason the kidneys become disabled.

MUCUS.

Mucous membrane, or the reflection of the skin which lines the cavities of the body, is copiously provided with glands to secrete the fluids necessary to keep it moist and pliable. The name, mucus, has been given this. It is secreted by numerous, tiny glands which lie near the surface of the mucous membrane. Healthy mucus differs somewhat with the surface by which it is secreted, but differs from the other secretions of the body mainly by its viscidness which depends on a peculiar substance to which the name of *mucin* or *mucosin* has been given. When unmixed with the other animal fluids, mucus is tough and extremely tenacious and stringy when attempted to be drawn out. It is sometimes so thin and limpid as almost to resemble water in appearance; while at others, and more commonly it is tough and viscid. When thin and watery, it is nearly transparent and colorless, the more viscid forms, however, are turbid or opaque, and usually of a pale yellowish or grayish color. It is generally alkaline to test paper, insoluble in water, and somewhat heavier than that fluid; so that when placed in water it gradually sinks to the bottom, unless it is buoyed up by entangled air-bubbles. The mucus obtained from the several parts of the body differs considerably in appearance, and probably also in chemical composition. When dry it is hard and friable, resembling horn in appearance; the dry mass, on being digested in water, gradually swells up, and partially reassumes its former appearance.

When mucus is examined under the microscope, with a power of about 200 diameters, it is found to contain numerous round or oval granular corpuscles, together with epithelial scales entangled in a more or less viscid fluid, to which latter the peculiar tenacious character of mucus appears to be due. Mucus, therefore, consists of two distinct portions; the solid corpuscles with epithelial scales, and the fluid with which they are surrounded. Under favorable circumstances, and with a high magnifying power, the fluid portion appears to be filled with extremely minute molecular particles, the nature of which is not clearly understood.

The size of the mucus corpuscles varies considerably, the average diameter being about $\frac{1}{2,000}$ th of an inch. Their surfaces are granular, similar to those of pus. Mucus contains mucus corpuscles, epithelial scales, mucin, extractive matter, fat (traces) and sometimes a trace of albumen and saline matters, which, as may be seen in the annexed table, are made up of alkaline chlorides and lactates, phosphate of lime and carbonate of soda.

Mucin, to which the tenacity of mucus is due, is insoluble in pure water and is probably held in solution in mucus by the small quantity of alkali present in the same. When mucus is treated with an excess of distilled water the mucin separates as a white coagulum.

The composition of mucus, according to the analyses of Nasse, is as follows:

COMPOSITION OF PULMONARY MUCUS.

Water	955.52
Animal matter	33.57
Fat	2.89
Chloride of sodium	5.83
Phosphates of soda and potassa.	1.05
Sulphates " " 	0.65
Carbonates " " 	0.49
	1000.00

The varieties of mucus found in different parts of the body are probably not identical in composition, but differ a little in the character of their principal organic ingredients, as well as in the proportions of their saline constituents. The function of mucus is for the most part a physical one, viz.: to lubricate the mucous surfaces, to defend them from injury, and to facilitate the passage of foreign substances through the cavities lined with mucous membrane.

The tears are like mucus in their chemistry but contain only one part of solids to the thousand, and this chiefly chloride of sodium.

MUSCLES AND CONNECTIVE TISSUE.

Between the skin and the muscles lies the connective tissue, which, as its name denotes, binds all parts of the body together (See page 89). The various forms of connective tissue show marked chemical differences according to its age, function and animal kingdom to which it belongs. Under the microscope it shows a ground substance, containing cells and elastic fibers, and these chemically all differ one from another. The most important constituents of striated connective tissue is *Collagen* and in addition are found an insoluble albuminoid, probably identical with mucin, mineral constituents and fat. In the interstitial fluids of connective tissue, in the middle coats of the arteries, and in the cell sub-

stance of the corneal layer of the skin we find paraglobulin, or fibrinoplastic substance—which see later.

The most marked characteristic of the connective tissue is its solubility, or rather, of its ground substance in boiling water, which first swells it to a jelly-like substance, and then dissolves it, producing gelatine, the epidermis does the same.

Dilute inorganic acids and dilute alkalies also effect this transformation. There is believed to exist in this tissue a substance (collagen, glutine, geline) analogous with ossein, which, in contact with hot water, furnishes gelatine; also a substance (elastin) not furnishing gelatine.

Tannin and mercury bichloride form with these matters imputrescible compounds.

Cellular tissue is converted into a transparent and colorless jelly by the action of strong acetic acid; but the fiber is not attacked, for if the acid be saturated with ammonia water it reappears in its ordinary condition.

Collagen may be prepared by washing finely divided tendons with cold water, then covering with barium hydrate for some days, and later treating with cold water acidulated with acetic acid.

Collagen is insoluble in cold water, but in boiling water it is converted into gelatine, and forms a jelly-like mass on cooling. Dilute acids and alkalies hasten the conversion of collagen into gelatine; thus, if collagen be placed in dilute acid or alkali until it begins to swell and then be placed in water at 40 degrees, it will dissolve. In strong acetic acid, collagen swells, and the fibers become indistinct, but reappear when the acid has been washed out with water or neutralized with an alkali.

GELATINE.

Boil collagen prepared as above, and allow the solution to cool, when gelatine will form; or, pure gelatine is best prepared by dissolving clean white pieces of isinglass in dilute hydrochloric acid and removing the inorganic salts from this solution by dialysis, when pure gelatine remains.

Pure gelatine is an amorphous, transparent, yellowish-white, tasteless and odorless substance. In cold water it swells, but does not dissolve; in hot water it dissolves and is deposited in a jelly-like mass on cooling. It readily undergoes putrefaction and then gives off the odor of ammonia; putrefaction is prevented by carbolic acid. Gelatine heated in the flame swells, evolves the odor of burning feathers and burns with a pale flame. Gelatine when long heated in sealed tubes becomes so modified as to become soluble in cold water. Long boiling with dilute acids decomposes gelatine and converts it into leucin and glycocoll.

Gelatine and Chondrin do not preëxist in the animal kingdom, but

result from the action of boiling water on gelatinous tissues, such as skin, tendons and bones or the cartilages of the ribs.

ULTIMATE COMPOSITION OF GELATINE AND CHONDRIN.

	Gelatine.	Chondrine.
Carbon.....	50.0	49.1
Hydrogen.....	6.6	7.1
Nitrogen.....	18.3	14.4
Oxygen.....	25.1	29.4
	100.0	100.0

In addition to the above earthy phosphates are always present.

Gelatine is found in a pure state as isinglass (the dried swimming bladder of the sturgeon), and in a less pure state as calf's-foot jelly, glue and size. It is soluble in hot water, but insoluble either in cold water, alcohol, or in ether. It shrinks greatly in bulk when exposed to dry air. When perfectly dry, gelatine may be preserved indefinitely, but when moist it rapidly becomes acid, and putrefies.

A gelatine solution is precipitated as tanno-gelatine by tannic acid (the only acid known that possesses the power of precipitating it), by alcohol, by mercuric chloride, by mercurous and mercuric nitrates, and by chlorine (forming a chloride of gelatine). It is neither precipitated by alum nor by basic or neutral lead acetate.

Boiled with strong alkaline solutions, it is converted into leucin, or amido-caproic acid ($C_6H_{13}NO_2$) and glyocoll (glycoine) or amido-acetic acid ($C_2H_5NO_2$) with the evolution of ammonia.

The *elastic tissues* do not dissolve even after an ebullition of sixty hours, and do not furnish gelatine.

The basis of elastic tissue is an albuminous substance known as *elastin*, which is a yellowish white elastic substance when moist, but brittle upon drying. It again swells upon boiling with water or acetic acid, but is insoluble in both and also in alcohol and ether. When heated with a concentrated solution of an alkali elastin dissolves, forming a brownish solution which gives no precipitate on the addition of sulphuric acid. Concentrated nitric acid colors elastin bright yellow, and converts into jelly which turns reddish on the addition of ammonia. Long boiling with dilute sulphuric acid produces leucin and tyrosin from elastin, the former in larger quantity.

The *mucous areolar tissue* differs chemically from ordinary connective tissue, in that it does not furnish gelatine on being boiled with water.

The *reticular tissue* of the cutis contains the pigment called *melanin*, the coloring matter of the skin. This tissue is not reproduced completely where destroyed, but is replaced by cellular tissue, and the cicatrix is due to the fact that this latter tissue is colorless.

FAT.

As has previously been said fat is mainly contained in the meshes of connective tissue and widely distributed over the body. (See page 89.) The fat of the body is derived in part directly from the fats of food, and in part from its hydrocarbons and albumen as shown in cattle that are fattened by being fed upon corn. Similarly fat may be produced from albuminous compounds as muscle is known to become fatty with the aged. Unused muscle contains an excess of fat, and the change of the dead body into adipocere, a fatty substance, will be described under putrefaction. Fat is a normal constituent of the fluids of the body, except the urine, and is plentifully distributed through the tissues in health, and often to an excessive degree in pathological conditions of the system in almost any or every organ. It represents a low state of organization and when the tissue of the liver, heart or other organ becomes unduly transformed into fat, that organ will soon cease to perform its functions normally. The fat which accumulates pathologically is identical with that which, in smaller quantity, is a normal constituent of the tissues.

Fatty globules, even when present in small quantity, may be recognized by their microscopic appearance. They consist of a thin membrane, inclosing a fluid; in the dead body the contents of the membrane are sometimes found crystallized, in consequence of the removal of the heat of the body. These crystals generally appear in needles arranged in bundles or in rosettes. The perfect oil globule is spherical, floats upon water and is colorless or of a faintly yellow tint.

Some of the fats of the body are fluid and others solid at ordinary temperatures. They give a neutral reaction, since they consist of fatty acids combined with glyceryl forming neutral compounds. They are insoluble in water, sparingly soluble in cold, more freely in hot alcohol, and soluble in ether, chloroform and volatile oils; also soluble to some extent in each other; thus olive oil is a solution of palmitin and stearin in olein. Water containing albumen or bile-acid will hold fat in a finely divided state and will appear milky, while if fat be added to water alone the globules will float upon the surface. Upon being boiled with an alkali, the fats are broken up into glycerine and fatty acids, the latter combining with the alkali to form a soap. If the fats, for instance butter, be allowed to stand exposed to the air, it sooner or later becomes rancid, volatile oils being formed. The most important of the fats of the animal body are

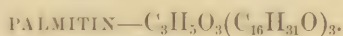


It may be seen from the formula that stearin is formed by the combination of three molecules of stearic acid with triad glyceryl.

Stearin is prepared as follows: Extract mutton or beef tallow with cold ether, which dissolves only traces of stearin; extract the residue insoluble in cold ether with hot ether, and allow this extract to cool when stearin is deposited in rectangular plates or prisms which are very sparingly soluble in alcohol. They melt at 63° C., solidify at 61° and before melting again must be heated to 66° .

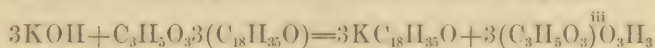


Pure olein at ordinary temperatures is a colorless fluid which becomes oxidized on exposure to the air and turns more or less yellow. It is freely soluble in ether and absolute alcohol, slightly so in cold dilute alcohol and insoluble in water. It is itself a good solvent for stearin and palmitin, the latter of which separates from olive oil by cooling (0°) and allowing to stand for twenty-four hours. The supernatant fluid contains the olein, which may be extracted from it by alcohol and crystallizes in needles at a low temperature (-5).]



It has already been stated that when olive oil is kept for some time at a temperature of 0° , palmitin is deposited in a crystalline form; these crystals, after the supernatant oil has been poured off, are dissolved in boiling alcohol from which they separate on cooling. They are slightly soluble in cold, freely soluble in hot alcohol, and ether. From a saturated solution in hot alcohol, palmitin forms in needles as the solution cools. If stearin be also present the mixture not unfrequently forms in balls which consist of radiating needles or fine plates; this mixture was formerly mistaken for a fourth fat and the name margarine given it from its pearly luster. This margarine will be found mentioned in all of the earlier works on animal chemistry.

All of the fats are insoluble in water but readily dissolved by ether. Prolonged boiling with a caustic alkali, or one of the stronger bases, as lead, decomposes these fats into glycerine and either stearic, oleic or palmitic acid, thus: Caustic potash and stearin heated together.



or three molecules of potassium stearate and one molecule of glycerine. (See antiseptics.) The different kinds of animal fats contain olein, stearin and palmitin in varying proportions, but as a rule the more solid the fat the larger the proportion of stearin it contains. Fatty matters show one peculiarity in the body which distinguishes them from all other proximate principles, viz.: their isolation by themselves. All of the other proximate principles are associated together but the fats are not found united with other elements than themselves, except in nerve

tissue where they are joined with albuminoid matter. So it comes to pass that the fats instead of making a coherent solid or fluid with other substances are found in masses or globules which are suspended in the interstices of anatomical elements, or deposited in the substance of fibers or membranes. What is known as adipose tissues consist of vesicles ($\frac{1}{1000}$ — $\frac{1}{500}$ m) entirely filled with fat and held in a thin structureless membrane. During emaciation the oil and fat contained in these gradually disappear and their place is taken by a watery serum. For the chemistry of the assimilation and digestion of fats see digestion.

CARTILAGE.

There are both histological and chemical differences between true or hyaline cartilage, and the fibrous variety or fibro-cartilage. The corpuscles of the former lie imbedded in a smooth, semi-transparent base; while the structure of the latter is distinctly fibrous; the basis of hyaline cartilage is *chondrogen*, while that of fibro-cartilage is *collagen*.

Chondrogen can be changed by boiling water into chondrin, a substance which resembles gelatine in some respects. Chondrin does not exist as such in cartilage, but only potentially in the chondrogen, or cartilagein, as it is sometimes called, from which the chondrin is prepared by prolonged boiling under pressure.

Dried chondrin is a glassy, transparent, yellowish substance, which is insoluble in alcohol and ether. In cold water it swells but does not dissolve, while in hot water it dissolves and separates as a jelly-like mass on cooling. It is also soluble in alkali. Like gelatine, chondrin if heated in closed tubes for some time at 140 degrees is so modified as to be soluble in cold water. It is not as soluble as gelatine in boiling water, and it is precipitated by acids. In the case of acetic acid the precipitate is insoluble in an excess of acid; but in the case of the other acids the least excess of acid effects the solution of the precipitate. Its solution is precipitated by alum and by lead acetate. It forms glucose when boiled with hydrochloric acid.

Glue is manufactured by boiling the parings of hides, etc., in water. The hides are first carefully cleansed from hair and blood by lime. This done, the lime is carbonized by free exposure, after which the hides are boiled in water. The liquid is then kept warm for a time so as to allow the impurities to subside. The solution is then cooled, the gelatinized mass being cut into slices and dried on nets in the air. The temperature at which the drying process is effected is important, for a summer heat would melt the glue, while a winter cold would spoil it.

The resemblance between chondrin and gelatine is so close that the following table, taken from Hoffmann's *Zoöchemie* is given, to indicate the differences between the two substances.

GELATINE.

C=50.0 H= 6.7
N=18.1 O=24.6

- (1) Not precipitated by acetic acid.
- (2) Soluble in mineral acids.
- (3) Not precipitated by acetate of lead, or alum.
- (4) Precipitated by tannic acid and mercuric chloride.
- (5) Yields leucin and glycocoll by putrefaction.
- (6) Yields no sugar on being boiled with hydrochloric acid.

CHONDRIN.

C=50.0 H= 6.6
N=14.4 O=29.0

- (1) Precipitated by acetic acid.
- (2) Precipitated by mineral acids.
- (3) Precipitated by acetate of lead and by most salts of the heavy metals, as alum.
- (4) Only rendered turbid by tannic acid and mercuric chloride.
- (5) Yields leucin but no glycocoll by putrefaction.
- (6) Yields chondroglucose on being boiled with hydrochloric acid.

Besides chondrin, cartilage contains water, fat and inorganic salts; the latter consisting of the phosphate and sulphate of lime, the phosphate of magnesium and the chloride, carbonate, phosphate and sulphate of sodium. It is an interesting fact, first observed by Von Bibra, that the salts of potash are not found in cartilage. The per cent of water contained in cartilage varies from 50 to 75. The per cent of inorganic salts varies from 3 to 7 and seems to depend upon the age of the animal from which the cartilage is taken. The following table, taken from the *Lehrbuch* of Gorup-Besanez, shows the per cent of ash found by Von Bibra in the costal cartilages of persons of different ages:

A child 6 months of age.....	2.24
A child 3 years of age.....	3.00
A girl of 19 years of age.....	7.29
A woman of 25 years of age.....	3.92
A man of 20 years of age.....	3.40
A man of 40 years of age.....	6.10

Approximate analysis of cartilage gives the following results:

Water.....	75.59
Organic matter.....	24.87
Inorganic matter.....	1.54
	100.00

Or by breaking these up into their elements:

Carbon.....	50.91
Oxygen.....	6.96
Nitrogen.....	14.90
Oxygen.....	27.23
	100.00

Chondroglucose. Sugar may be obtained from cartilage differing both from laevulo-glucose and dextroglucose, by the prolonged action of

dilute acid and boiling upon the cartilage, with the removal of foreign matters by lead acetate and filtration. This sugar reduces copper and is partially fermentable. See chemistry of digestion.

CHEMISTRY OF THE BONES.

Osseous tissue is composed of both inorganic (70 per cent) and organic constituents, differing chiefly from cartilage by the mineral salts which have been deposited during the change from cartilage to bone, not by incrustation but by deposition of the inorganic matter particle by particle.

Omitting for the present the periosteum, or external membrane of the bone, and the internal membranes, marrow, etc., we may say that bone consists of an organic substance, called ossein, with inorganic compounds. It has been stated that iron has been found in bone, but if present, it is probably due to the retention of blood in the bone.

Bones deprived of their fat and periosteum, are according to Berzelius, composed of :

		Man.
Mineral portion	{ Calcium phosphate.....	53.04
	{ Calcium carbonate.....	11.30
	{ Magnesium phosphate.....	1.16
	{ Sodium chloride and carbonate.....	1.20
Organic portion	{ Cartilage (Ossein).....	32.17
	{ Blood vessels.....	1.13
		100.00

The mineral portion of bone may be separated from the organic by keeping the bone at a red heat until all of the organic matter is removed. The bone will still preserve its original form, but becomes very brittle. On the other hand the inorganic salts may be removed and leave the organic behind by simply soaking a bone for a long enough time in dilute muriatic acid. A bone thus treated retains its form but becomes flexible, yellowish and translucent and now consists almost exclusively of ossein, which has the special characteristic of being transformed by boiling water into gelatine (See page 161). Ossein becomes hard upon drying, and again pliable and elastic when placed in water.

The bones of the embryo, even to the latest period of intra-uterine life, contain no ossein but chondrogen; while, after complete ossification, the bone contains no trace of chondrogen. Fremy found that the organic basis of some fish bones and of the bones of certain water-fowls, after being boiled with water, deposited no gelatine and consequently differs from ossein.

Fossil bones contain that modification of collagen which is soluble in cold water, and together with this, in some cases, the ordinary form, *i. e.*, that soluble in hot water and forming a jelly on cooling; the latter may

be entirely replaced by the former. In very old fossil bones, the organic basis has entirely disappeared; also parts of the bone are replaced by silica and alumina, forming a petrification. Fresh bones when completely freed from blood and marrow contain no iron, but this element is often found in considerable quantity in buried bones. Haidinger found the medullary canal of the bones of a human skeleton containing crystals of vivianite.

The fat contained in bones has not been very thoroughly studied, but consists principally of triolein and tripalmitin.

The inorganic constituents of bone are calcic chloride, CaCl_2 , calcic fluoride, CaF_2 , calcic carbonate, CaCO_3 , calcic phosphate, $\text{Ca}_3(\text{PO}_4)_2$, and magnesian phosphate, $\text{Mg}_3(\text{PO}_4)_2$.

Aeby is of the opinion that the cartilage and calcium phosphate of the bones are not combined, but that the organic foundation of the bones simply induces ossification without entering into chemical relations with the calcium phosphate. And it may be readily proven that ossein is not combined chemically with the calcium of the bones, by boiling a quantity of ossein equal in weight to that which exists in a given weight of bone and treating that weight of bone at the same time with boiling water when it will be found that the transformation into gelatine is as rapid in one case as the other.

How bones are formed and in what way they grow is a question of no little importance and one which is not yet fully understood. It seems that the chondrogen of the fetus is not transformed into ossein or collagen, but is replaced by it. We know but little more concerning the inorganic part of the bone. It has been proven that the chick as it escapes from the shell contains more lime than the interior of the egg, and that the shell has, during the period of incubation, lost an equal amount of lime. The following facts seem to be well proven in reference to the composition of human bones, viz.:

1. There is a close resemblance in their chemical composition in the bones of the higher animals.

2. The bones of the young contain more animal matter and less earthy matter than the bones of adults. There is, however, no well-marked gradation in the proportions.

3. The composition of bone is influenced by certain diseases. The alteration generally consists in a diminution of the earthy constituents; for instance, in caries, where the inorganic-portion of the bone is destroyed and the organic remains almost intact. In rachitis the mineral salts are removed to such an extent that the bones are no longer capable of supporting the body, and the ossein is also changed, for boiling water no longer changes it into gelatine, but takes an acid reaction.

4. The composition of bone varies slightly with the part from

which it is derived. Thus the femur and humerus contain more earthy matter than the tibia and fibula or the radius and ulna, whilst the scapula, the sternum and the bones of the trunk contain less earthy matter than the long bones.

5. It would seem that the bones of males contain slightly more earthy matter than the bones of females.

The *marrow* of the long bones consists of collagen containing fats. The cellular tissue of the spongy bones contains a soft, reddish substance which consists of albumen, free acid and extractive matters. Whether the free acid be lactic, as claimed by Berzelius, is not yet positively known. Cholesterin is not an infrequent constituent.

Marrow is formed, according to Berzelius, of—

Fat.....	96
Blood-vessels, membrane, etc.....	1
Extractive substances.....	3
	100

According to Eylerch, the fatty matter of marrow is constituted of three ethers of glyceryl whose acids are the palmitic, medullie and elaidic.

The membrane which covers the walls of the osseous canals is formed of an albuminoid substance insoluble in boiling water. Nitrogenous bodies derived from the blood-vessels and nerves are also found in the bones, as well as fatty matters.

Chemism: (a) Action of heat in open vessels. The organic matter burns away, leaving a white “bone-ash” ($\text{Ca}_3\text{P}_2\text{O}_8$). This residue is used in the manufacture of phosphorus, and also as a manure, in the form principally of superphosphate.

(b) Action of heat in closed vessels (destructive distillation). Ammonia and tarry matters (bone-oil or Dippel’s oil) are given off, the residue in the retort constituting “animal charcoal” or “bone black.”

This consists of a mixture of phosphate of lime and finely divided carbon. Animal charcoal is largely used by the sugar refiners. When its deodorizing power has been exhausted, it is burnt for the purpose of recovering the bone ash.

(c) Action of water. When bones are boiled in water at 212 deg. F. (100 deg. C), all that occurs is the separation of the grease present in the bone. This floats on the surface of the water, the ossein of the bone being insoluble. If the bone, however, be digested in water at a temperature of 100 deg. F., as in a Papin’s digester, the organic matter is rapidly converted into gelatine, which is soluble in water. This converted ossein is used in glue.

(d) Action of acids. When dilute hydrochloric acid is added to

bone, effervescence first occurs by its action on the lime carbonate. In time the dilute acid dissolves out the whole of the earthly phosphates, etc., leaving only the ossein (the organic constituent of the bone), a semi-transparent, horn-like body, which by the action of heat under pressure is converted into gelatine.

DENTAL TISSUES.

Three substances are distinguished in the teeth: the *dentine*, which forms the greater part of the teeth; the *cement*, which covers the cervix and roots, and the *enamel*.

The cement has a structure similar to that of the bones. It has a cavity which contains the nerves and blood-vessels, and in which arise the little canals which ramify and penetrate to the surface of the teeth. Treated with an acid, it parts with its inorganic constituents, and there remains an organic residue capable of furnishing gelatine, according to some authors, though denied by Hoppe-Seyler. The cement has the composition, substantially, of the bones.

The enamel is hard and brittle; it contains about ninety per cent of calcium phosphate, and a considerable quantity of calcium fluoride, and only two to six per cent of organic substances.

The enamel is the poorest in water and richest in organic salts of any part of the body. The organic part of the enamel, when separated from the inorganic by solution of the latter in hydrochloric acid, appears as four or six-sided prisms, which on being boiled with water do not form gelatine and which behave as epithelial tissue. The enamel of the growing teeth contains more organic matter than that of the fully developed tooth. The fluid which surrounds the tooth as it is inclosed in the dental sack is strongly alkaline in reaction and contains albumen. Berzelius gives the following analysis of dental tissue, viz.:

Organic matter.....	28.0
Calcium phosphates.....	64.4
Magnesium phosphate.....	1.0
Calcium carbonate.....	5.3
Sodium carbonate and chloride.....	1.3
Water, animal matter, alkali (traces).....	
	100.0

Molar teeth appear to contain more mineral matter than the incisors (Bibra). The relation of the calcium phosphate to the calcium combined with carbonic acid, and in some analysis with chlorine and fluorine, suggests an analogy between the combination of the enamel and the mineral apatite, and this combination makes the teeth almost as enduring after death as the mineral itself.

MUSCULAR TISSUE.

A chemical analysis of muscle is attended with many difficulties owing to the changes produced by various causes: thus, muscle at rest manifest a neutral or an alkaline reaction, while the contracted muscle gives a distinctly, acid reaction. Again as long as the muscle is contractile and living, it contains a fluid resembling the plasma of blood; while in the dead muscle, coagulation of this fluid has taken place. So long as the muscle is contractile, its plasma is transparent; while after the supply of blood has been cut off, the muscle becomes shorter, thicker, less elastic and less transparent. Besides albuminous substances, muscle contains many other organic and inorganic constituents, for chemically it is an exceedingly complex compound.

The muscles under the microscope consist of a reddish contractile tissue (see page 88) with an external envelope (sarcolemma) and the muscle substance proper. A chemical analysis of muscular tissue, according to Von Bibra, gives the following results:

COMPOSITION OF FLESH.

	Pectoral Muscles.	
	Man.	Woman.
Water.....	72.46	74.45
Muscular fibres, vessels and nerves.....	16.83	15.54
Fats.....	4.24	2.30
Extractive matters.....	2.80	3.71
Cellular tissue.....	1.92	2.07
Soluble albumen.....	1.75	1.93
	100.00	100.00

Flesh leaves from 2 to 8 per cent of ash, formed chiefly of alkaline and earthy phosphates; sodium chloride and sodium sulphate are also present.

* Muscle, therefore, contains about three-fourths its weight of water, one part of which is due to the blood present, and a second part to the "juice of flesh," as it is called, *i. e.*, an acid liquid containing creatine, inosite and certain salts, together with phosphoric, lactic and butyric acids, each of which demands examination more in detail.

Muscle juice, or plasma is the name given the fluid which bathes the ultimate fibers of the muscle during life. It may be separated from the muscles of a very recently killed animal by freezing them, for at -7° muscular substance becomes very brittle and can be pulverized in a well-cooled mortar with snow containing 1 per cent of common salt. At -3° the mass melts and a cloudy fluid may be obtained by filtration at 0° . This opalescent, yellowish, viscid alkaline fluid is muscle plasma, which, on exposure to an ordinary temperature, becomes transformed into a jelly-like mass with a supernatant fluid.

Myosin may be prepared by allowing the above filtrate, kept cold, to fall into water at ordinary temperature, drop by drop. As each drop falls a fine white precipitate falls, which is myosin. Myosin therefore is not a constituent of living muscle, but one of its death products, and corresponds to the fibrin produced by the coagulation of blood. Unlike fibrin myosin is not at all fibrinous but forms in transparent flakes which are insoluble in water but soluble in dilute solutions of common salt, from which solutions it does not separate upon standing. Boiling and alcohol separate it from its solutions, but at the same time change it into albumen, soluble in alkalis and forming albuminates.

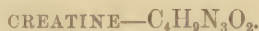
Syntonin, according to Wheeler, is produced when an acid, saturated solution of myosin is used instead of the one mentioned above, and differs from myosin in not dissolving in solutions containing less than 10 to 12 per cent of common salt. According to the same author solutions of syntonin in acid are not coagulated by boiling, but are by the chlorides and alkaline sulphates. Syntonin dissolves in caustic alkaline fluids, and in dilute solutions of the carbonates and reprecipitates when these solutions are neutralized, even when the alkaline phosphates are present, wherein syntonin differs from the albuminates.

Muscle serum is the name given to the faintly yellowish fluid which separates after the coagulation of muscle plasma (See page 171).

The liquid which remains after the coagulation of myosin contains, according to Kühne, two albuminoid substances, one coagulable at 75 degrees the other at 45 degrees, and alkaline albuminates; also salts, which are chiefly phosphates, lactic acid, and lactates, sugar and various organic substances, as creatine, creatinine, inosic acid, inosite, sarcosine, sarkin and xanthin. This liquid is coagulable by heat, and of a red color; its acidity is due to lactic acid and acid phosphate of potassium, which may be extracted from the muscles by dilute alcohol.

It is claimed by Frémy and others that there exists in the muscle a special acid, called *oleophosphoric acid*, and that this acid is combined with sodium.

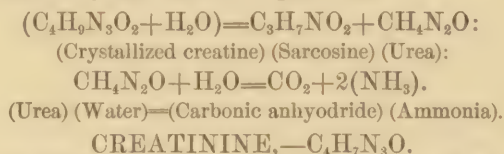
According to Dubois Raymond, the muscles do not possess an acid reaction until after death, and while contractile their reaction is slightly alkaline. (See putrefaction.)



Creatine is found in varying proportions in the muscles of all vertebrates and of some invertebrates. According to Hofmann, the amount of creatine in human muscle varies from 0.14 to 0.49 per cent. About the same amount is found in the muscles of the ox, dog and cat. A somewhat larger per cent is present in the flesh of the domestic fowl and

of the frog. Creatine exists normally in small quantities in the brain, in blood, in the urine, and in various transudations.

Creatine crystallizes in beautiful prisms with many modifications. These contain one molecule of water of crystallization and are represented by the formula, $C_4H_9N_3O_2 + H_2O$. The crystals are sparingly soluble in cold, freely soluble in hot water. From a saturated solution in hot water, creatine is deposited in fine needles on cooling. It is insoluble in cold alcohol and ether, soluble in hot dilute spirits of wine. Its solutions are neutral to litmus and have a bitter, irritating taste. If crystals of creatine be heated to 100 degrees, they lose their water of crystallization and become opaque. Creatine readily gives off ammonia when boiled with baric hydrate, first being converted into sarcosine and urea, as may be seen by the annexed equations:



Creatine is so easily converted into creatinine, that it is not certain whether the latter exists preformed in muscle or not. The small amount of creatinine which has been obtained by some chemists from flesh might have been produced from creatine during the process of separation. Creatinine is a constant constituent of normal urine. It is best prepared from creatine by the action of the mineral acids. Heat creatine with dilute sulphuric acid on the water-bath for one hour. Neutralize the solution with baric carbonate, filter and evaporate the filtrate until creatine crystallizes.

Creatinine forms in prisms which belong to the monoclinic system. It is more freely soluble in water than creatine is; creatinine requiring only 11.5 parts of cold water for solution. It is sparingly soluble in cold alcohol, freely soluble in hot alcohol. From its solution in hot alcohol, creatinine crystallizes on cooling. Its solutions have a caustic taste resembling that of ammonia and give a decidedly alkaline reaction. Creatinine is a true animal alkaloid, combining with acids forming salts and liberates ammonia from its combinations.

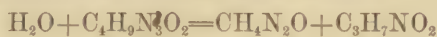
It will be seen, therefore, that the amount of creatine and creatinine, present in the body and its excretions depends largely upon the kind of food taken. Liebig found that a dog fed exclusively upon muscle excreted largely quantities of creatine and creatinine and but little when kept upon fatty foods. Creatinine may be reconverted into creatine by boiling with lead oxide.

It forms with zinc chloride a combination which is but slightly soluble in cold water. According to Neubauer, creatine does not exist in

flesh, but creatinine only, and the creatine which is found is formed by the transformation of the creatinine. Creatinine also exists in urine, and in the muscles of the crustacea.



Prep. On submitting creatinine to a prolonged ebullition with baryta water another substance is formed, called *sarcosine*.



. Water. (Creatinine.) Urea. Sarcosine.

This body crystallizes in rhombic crystals, which are colorless, very soluble in water, somewhat soluble in alcohol and insoluble in ether. Sarcosine melts at a temperature above 100° , and is volatile. It is not a constituent of muscle but like creatine a derivative and interesting as one of the steps in the decomposition of muscular tissue.

Inosic acid. The mother liquor of creatine is acid, and has an odor of meat broth. Extract of meat treated with baryta furnishes on evaporation inosate of barium, and the liquid contains inosite. The formula of inosic acid is usually given as $\text{C}_6\text{H}_8\text{N}_2\text{O}_6$, though some authors regard it as $\text{C}_{10}\text{H}_{14}\text{N}_4\text{O}_{12}$.



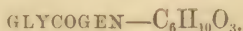
Inosite, also known as muscle-sugar, is found not only in muscle, but also in the vegetable world, especially in green fruits and grains. It is present in the urine in diabetes mellitus, and in some forms of albuminuria. The muscular tissue of those long accustomed to the excessive use of alcohol, contains more inosite than that of healthier persons.

Preparation: Inosite is best prepared from the muscles of the heart, in the form of large rhombic plates, containing two molecules of water of crystallization. It has a sweet taste and is soluble in water, but insoluble in cold alcohol and ether. Its aqueous solution does not ferment with yeast, nor does it reduce cupric oxide, although it acts as a solvent for it. At 210° inosite melts and on cooling reforms in acicular crystals.

Inosite boiled with Fehling's solution does not reduce the copper, but changes the color of the solution from blue to green. It does not produce a brown coloration when boiled with potassic hydrate, or, in other words, fails to give Moore's test for sugar. It will be seen that inosite resembles grape sugar in its chemical composition, but the failure of the former to respond to the ordinary tests for the latter affords an easy method of distinguishing between the two.

If inosite be dissolved in water containing albumen and the solution be set aside in a warm place, as the albumen decomposes the inosite will be broken up, forming lactic and butyric acids. If an aqueous solution

of inosite be boiled with basic acetate of lead, a jelly-like mass is precipitated.



Glycogen exists in the muscle, white corpuscles, and in all developing cells of the animal. The muscular tissue of the fœtus is especially rich in this constituent. It has been found in the placenta in large quantities; it exists in the embryo of the chick, and is abundant in the *ostrea edulis* and *cardium edule*. During fœtal life the liver contains but little glycogen, while in the adult this organ seems to be the great manufactory and store-house of this substance. Only in structural disease of the organ, is the liver of any vertebrate animal free from glycogen.

The process of its extraction is too tedious to be here described in detail, but when properly prepared glycogen is a white, amorphous, tasteless, odorless powder, which is freely soluble in water and insoluble in alcohol or ether. If glycogen be dried without having been previously washed with strong alcohol it forms a pasty mass.

Its aqueous solution is opalescent, but becomes clear on the addition of sodic hydrate which stains red; if dried glycogen be treated in the same manner, a brown color is produced. If glycogen be boiled with dilute hydrochloric acid, the former is converted into grape sugar; the same change is produced by the action of the saliva, pancreatic juice or blood.

If to an aqueous solution of glycogen a few drops of blood be added and the mixture be kept on the water-bath for some time at a temperature of 40° , then freed from albumen and tested with Fehling's solution, sugar will be found to be present. The blood acts as a ferment converting the glycogen into sugar, this conversion consisting in the assumption of a molecule of water.

It will be seen both from the formula and from its various reactions that glycogen is a starch. It is especially abundant in the liver of animals which have been fed upon starchy or saccharine food. In some animals, the rabbit, for instance, after prolonged fasting the glycogen entirely disappears from the liver. Food consisting principally of fat does not increase the amount of this substance. What becomes of the glycogen of the liver is a question not positively decided. It is supposed to be gradually converted into sugar which is oxidized in the blood and assists in the production of muscular activity; but how the blood oxidizes the sugar is not known.



This substance is always present in the muscles and has been found in the bile and urine after poisoning with phosphorus and also in the bones in cases of osteomataxia.

Paralactic acid is, at ordinary temperature, a liquid of a syrupy con-

sistency and miscible with water in all proportions. It combines with many bases, acting as a monobasic acid and forming characteristic compounds. Of these, one of the most important is the paralactate of zinc, which by the spontaneous concentration of its aqueous solution forms in fine prisms often arranged in bundles. The paralactate of lime is formed when calcic hydrate is boiled with paralactic acid, the excess of lime removed by precipitation with carbonic acid gas and filtration and the filtrate concentrated.

NERVE TISSUE.

Nerve tissue of which are composed the nerves, ganglia, brain and spinal cord (See page 58) has not yet been fully analyzed. Nerve substance, or the semi-liquid medullary substance, which flows out of a cut nerve is soluble in cold dilute caustic potash, their sheaths or membranes are not dissolved by the alkalis but readily so by hydrochloric or sulphuric acid. The ganglia are formed of cells of variable size, consisting of a thin envelope containing a dense liquid, a nucleus and granules in suspension.

The reaction of the nerves appears to be neutral during life; it becomes acid after death, and finally, at the moment when putrefaction sets in, it has an alkaline reaction.

Different investigations made recently on the matter of the nerves and brain have shown that we are far from completely understanding its compositions. Liebrich's *protagon* is now regarded as a mixture of cerebrin and lecithin; and the same may be said of myeloidin and myeloidinic acid.

The constituents of the brain, more or less constant and normal, thus far determined with apparent certainty, are:

- (1) *Water*: (2) *Albuminoid bodies resembling myosin—elastin—neurokeratin—nuclein—collagen—soluble albumen, coagulating at 75°—cerebrin and lecithin—glycerin-phosphoric acid—fats—cholesterin, inosite—hypoxanthin, xanthin, creatine, lactates—volatile fatty acids and uric acid—Inorganic substances.*
- (3) *Calcium, potassium and magnesium phosphates, iron, oxide, silica, alkaline sulphates, sodium chloride and fluorine.* (Horsford.)

Although very extended and repeated investigations of the chemical nature of the brain have been made, it is yet the organ of the body whose chemistry is least understood, for its compounds are exceedingly complex, and isolated with great difficulty, and many are more or less changed during extraction. Such a list as that just given must be received with great caution, for many of the ultimate analyses from which the formulæ of these substances are computed have most likely

been made from mixtures rather than pure chemical compounds. Consequently a full history of all the substances which some claim to have discovered in the brain will not be given here; only a few of those best known and most thoroughly studied will be noticed. First and most important of these are the substances known as albuminoid bodies—from their resemblance to the albumen or white of an egg, as their name, from the Latin word for white, denotes.

ALBUMEN.

Synonyms: *Eiweis* (Ger.), *Albumina* (It. and Span.), “Coagulable lymph,” “Coagulable animal lymph” (Rouelle, 1771-76), “*Deuxieme espece de gelee animale.*” Fourcroy.

The name first given to the white of an egg, and later applied by Gaetner to the substance which surrounds the embryo of certain grains, is now used to denote a large class of organic bodies containing carbon, hydrogen, nitrogen, oxygen and sulphur.

These bodies form the chief part of the solid constituents of animal organs. They are also found in small quantities in vegetables and are known as proteids, or albuminoids.

The formula $C_{72}H_{112}N_{18}O_{22}S$ represents their composition approximately. They are all amorphous; and turn the plane of polarization to the left. They are insoluble in alcohol and in ether, but are soluble in water, in acetic and the mineral acids and in the alkalies. They may be known by forming a yellow solution with nitric acid (xanthoproteic acid) which becomes orange-red when treated with ammonia. The caustic alkalies decompose them. They are precipitated from their solutions by acetic acid and by mercuric nitrate (Millon's reagent), leaving, in the latter case, a red supernatant solution. They resemble each other chiefly in their property of coagulation, and in their being colloid or impossible to dialyze, and all yield ammonia and calcium phosphates upon calcination. For the purpose of the present work they may be conveniently spoken of in the following groups:

(a.) Resembling egg albumen with the annexed percentage of oxygen, carbon, nitrogen and sulphur. Serum albumen, paralbumen, syntonine blood fibrin and coagulated albumen are usually grouped here according to Robin's classification. According to Gorup-Besanez their percentage composition is about as follows:

Carbon.....	52.7
Hydrogen.....	6.9
Nitrogen.....	15.4
Oxygen.....	20.9
Sulphur.....	0.8
	100

(b.) Contain more nitrogen and less carbon, *e.g.*, keratin, ossein, epidermose, mucin, gelatines.

(c.) Nitrogeneous glucosides, *e.g.*, chondrin and chitin, etc.

N. B. The so-called coagulated albumen of false membranes is improperly named, for by filtration through powdered MgSO_4 we obtain pure blood albumen, while the analogous, coagulable substance is coagulated and retained by the magnesia filter. Another and perhaps a better classification is that of Hoppe-Seyler, who arranges them as follows:

ALBUMENS.

Class 1 (Soluble in water).

NAME.	SOURCE.	PROPERTIES.
Ser-albumen.	Blood-serum.	A yellow, elastic, transparent substance. It is not precipitated by a small quantity of very dilute acid, but is precipitated by the addition of strong acids. Soluble in excess of muriatic or nitric acid.
		When injected into the veins, it does not, like egg albumen, pass into the urine.
Ov-albumen.	Eggs.	Coagulated by ether and turpentine. It is soluble in strong HNO_3 . When injected into the veins it passes into the urine unchanged.
Veget-albumen.	Plants.	Like ov-albumen.

Dried egg albumen closely resembles gum arabic; but on the addition of water remains as a white insoluble powder, unless the liquid contains a free alkali, in which dried albumen is freely soluble, forming a yellowish liquid, from which it is reprecipitated upon the addition of acids. It is also precipitated by heat, carbonic acid and even a large excess of water. All albuminoid substances heated with an alkali form from their sulphur, sulphides and hyposulphites, and if left to themselves are very ready to putrefy and give off disagreeable sulphuretted compounds.

CLASS II. GLOBULINS.

(Insoluble in water, but soluble in dilute acids and alkalies, and also in dilute solutions of common salt, or other neutral salts.)

NAME.	SOURCE.	PROPERTIES.
Myosin.	Muscle.	Coagulated by heat and by alcohol. It is soluble in very dilute HCl , rapidly becoming acid albumen.

Globulin (para-globulin.)	Prepared from blood serum by passing CO_2 through a dilute solution.	The globulin from blood serum is Fibrino-plastic, <i>i. e.</i> , it can form fibrin in contact with certain fluids (para-globulin). In this respect it differs from the globulin of the crystalline lens (globulin).
Globulin	Aqueous humor and crystalline lense.	Precipitated by CO_2 , or by very dilute acids from its solution in NaCl. Soluble in water saturated with oxygen, and in very dilute alkaline solutions; but if the solution contains one per cent of alkali it dissolves as an albuminate, and not in a free state. It is converted into an acid-albumen by dilute acids. It coagulates at 158 degrees F. (70 degrees C.)
Fibrinogen	Pericardial fluid Hydrocele fluid, etc.	Produces fibrin when mixed with fibrino-plastic globulin (fibrino-genous). It is more difficult to precipitate by CO_2 , and less difficult to precipitate by a mixture of alcohol and ether, than globulin.
Vitellin.	Yolk of egg.	Vitellin is the residue left after treating the yolk with ether. It is a white granular body, insoluble in water and soluble in solutions of neutral salts. It is neither fibrino-plastic nor fibrino-genous. It is converted into acid albumen by dilute acids and is soluble in dilute alkalies as an albuminate.

CLASS III. DERIVED ALBUMENS.

(Insoluble in water and in dilute salt solutions; soluble in dilute acids and alkalies.)

NAME.	SOURCE.	PROPERTIES.
Acid albumen.	Chemistry.	If the albumens of Class I be acted on with a small quantity of dilute acid (muriatic or acetic), the coagulation of the albumen does not occur at 70° C. and its levo-rotary action on a polarized ray is largely increased (acid albumen). On neutralizing the acid solution, a white precipitate of albumen is thrown down, which will now be found to be insoluble in water or a NaCl solution, but soluble in an excess of alkali or of alkaline carbonates. Coagulates at 70° C. The albumens of Class II. are soluble in dilute acids as acid-albumen. The solution yields a precipitate when neutralized, which is not soluble in neutral saline solutions.
Alkali-albumen, or albuminate.		Alkalies, like acids, prevent the coagulation of albumen (albuminates), the albumen being precipitated in neutralizing the solution.
Casein.		Casein is closely allied to the artificial albuminates.

CLASS IV.—FIBRIN.

(Insoluble in water, and but slightly soluble in neutral saline solutions or in dilute acids and alkalies.)

NAME.	SOURCE.	PROPERTIES.
Fibrin.	Blood, lymph, chyle.	Believed to be formed by the contact of fibrino-plastic and fibro-genous substances. (See Blood.) It is insoluble in water except at very high temperatures, or after a very lengthened action. Fibrin is very elastic and possesses a filamentous structure. It swells up when acted on with dilute acids and alkalies, and after their prolonged action, aided by heat, dissolves slightly.

CLASS V.—COAGULATED PROTEID.

(*Insoluble either in dilute or strong acids, except acetic acid; soluble in the gastric fluid (pepsin) which converts it into syntonin and finally into peptone.*)

Properties.—This body is produced by the action of heat or of alcohol on neutral solutions of albumen, fibrin, myosin, etc. Strong HCl and also ether convert egg-albumen into a coagulated form. Heat similarly converts the albuminates into a coagulated form, but the precipitate may be reconverted into the albuminate by potassic hydrate.

CLASS VI.—PEPTONES.

(*Bodies formed by the action of the gastric juice on albuminoids: soluble in water, insoluble in alcohol and ether.*)

NAME.	SOURCE.	PROPERTIES.
Peptones.	Stomach and small intestines only. (See Digestion.)	These bodies are highly diffusible. They are not precipitated by acids or alkalies.

The following table taken from Fowne exhibits the reactions of the several proteids before named.

I.

- a. Soluble in water :
 - { Aqueous solutions not coagulated by boiling. Peptones.
 - { Aqueous solutions coagulated by boiling. Albumens.
- b. Insoluble in water :
 - Soluble in a one per cent solution of sodic chloride. Globulins.

II.

- a. Insoluble in water, but
 - { Soluble in hydrochloric acid (0.1 p. c.) in the cold.
 - { Soluble in hot spirit. Alkali-Albumen.
 - { Insoluble in hot spirit. Acid-Albumen.
- b. Insoluble in hydrochloric acid (0.1 p. c.) in the cold:
 - Soluble in hydrochloric acid (0.1 p. c.) at sixty degrees C. Fibrin.
- c. Insoluble in hydrochloric acid (0.1 p. c.) at sixty degrees C.
 - { Insoluble in strong acids. Coagulated Proteid.
 - { Soluble in gastric juice. Albumen.
 - { Insoluble in gastric juice. Amyloid.

CEREBRIN.

The formula of this substance is probably $C_{17}H_{33}NO_3$. It was first prepared by Müller who made many analyses of it and deduced the formula given above. Otto discovered a substance resembling Müller's cerebrin but containing no nitrogen. It is prepared from brain substance by coagulating by heat an aqueous solution; the coagulum is washed with

water and exhausted with hot alcohol and ether. This solution contains cholesterin, lecithin and cerebrin, which may be isolated by appropriate means.

Prepared in this way, cerebrin is a white, odorless, tasteless powder, insoluble in cold water, alcohol or ether. Boiling water forms with it a pasty mass, but hot alkalies have no effect upon it. Cerebrin, when boiled with dilute mineral acids, is quickly decomposed, forming a sugary substance incapable of alcoholic fermentation, and another compound whose properties have not yet been studied. Under the microscope it shows granules or more frequently fibers more or less twisted. Solutions of cerebrin in hot alcohol are without action upon litmus paper. If some cerebrin be placed upon platinum foil and gradually heated, it becomes brown at 80°, then melts and finally burns with a reddish flame.

LECITHIN— $C_{42}H_{84}NPO_9$.

Lecithin is found in both vegetables and animals, as a constituent of the fluids of the cell in the former and in all the principal fluids of the latter. It is a constituent of spermatie fluid, of the fluids and yolk of the egg, of the blood, bile, transudates, nerves and brain. It may be prepared from any of the above mentioned substances, but is generally obtained from either the brain or the yolk of the egg, since these are rich in lecithin.

From the Brain.—A brain freed from its membranes and blood-vessels is rubbed up with a little water: the pulp kept at 0° is repeatedly extracted with ether: the residue is freed from any water or ether by pressure: the cake is digested with alcohol at a temperature of 40°; the mixture is filtered while warm: the filtrate is kept at or below 0° for some time, when impure lecithin containing cholesterin is deposited: this is collected upon a filter and washed with cold absolute alcohol and ether. The mass is again dissolved in alcohol at 40° and the solution is surrounded by a freezing mixture, when lecithin is in part deposited while another part remains in the solution and is obtained by evaporation.

Lecithin is a brittle, colorless substance which is soluble in alcohol, very freely soluble in hot alcohol, less but yet quite soluble in ether, also soluble in benzol, chloroform and bisulphide of carbon. In hot water it swells and forms a pasty mass but does not dissolve.

If lecithin be boiled with baric hydrate, it is soon decomposed with the formation of cholin or neurin, glycerophosphoric acid and the fatty acids.

GLYCEROPHOSPHORIC ACID— $C_3H_9PO_6$.

This acid is found in the body only as it results from the decomposition of lecithin; it is found in the brain in cases of softening of that

organ, in the blood and urine in leucocythæmia and in various transudates. It can be prepared from the yolks of eggs, from brain or from any substance containing lecithin. It may also be prepared by the direct action of glacial phosphoric acid upon glycerine. It is a syrupy fluid which at ordinary temperature slowly breaks up into glycerine and phosphoric acid. It is a dibasic acid forming salts with various bases; of these, the baric and calcic compounds are insoluble in absolute alcohol, soluble in water. The calcic salt is less soluble in hot than in cold water, and crystallizes from its solution in the latter on being raised to the boiling point.

NEURIN OR CHOLIN— $C_5H_{15}NO_2$

is one of the products of the decomposition of lecithin, and may be prepared from brain tissue or the yolk of eggs. Cholin is a colorless syrup of a decidedly alkaline reaction soluble in water and alcohol, and uniting with acids to form salts readily decomposed again. The most characteristic of these is its double chloride with platinum or gold, which, however, has more interest to the theoretical chemist than to the practical embalmer. The same may be said of the remaining constituents of cerebral and other nerve tissues for the composition of the spinal cord, of the medulla oblongata, of the nervous fibers and ganglia is very similar to that of the cerebral substance. The medulla oblongata contains the largest proportion of fatty bodies.

The mineral salts constitute about five per cent by weight of the brain in a dry state. When the brain is in full action the elimination of phosphorus appears to be greater than when it is in repose, since the quantity of alkaline phosphates in the urine increases.

FLUIDS OF THE BODY.

Neurin completes the list of the important proximate principles of the body other than those dissolved in its fluids which still remain to be considered. The fluids are blood, bile, milk, saliva, gastric and pancreatic juices, lymph, chyle and urine, for mucus and the secretions of the skin have already been considered (pp 158-160). By far the most important of all these fluids is

THE BLOOD,

upon which depends so largely the purifying and nutrition of the body that modern science accepts the biblical statement that "the blood is the life thereof." Its morphology has been described on pp 78-82, but still further space will be required for its chemistry, for its variable and invariable constituents make it the most complex and interesting fluid known to modern chemistry. These constituents may be divided into:

1. *Inorganic salts*, already considered, viz.: the sulphates, phosphates, carbonates and chlorides of potassium, sodium, lime and magnesia with 68 per cent of water.

2. *Invariable proximate principles*, viz.: albumen, hæmoglobin, stearic and palmitic acids, with glycerides and soaps of the same, lecithin, glycono-phosphoric acid, glucose, uric acid, creatine and creatinine.

3. *Variable Constituents*, viz.: formic, acetic, butyric acids, the biliary acids and pigments, uric acid and hypoxanthin, gluten and pseudo-gluten, lactic, hippuric and succinic acids, indican, inosite, leucin, tyrosin, and according to Verdeil, a peculiar reducing agent which upon heating gives off the odor of caramel. Hence in speaking of the composition of the blood it can only be stated very generally; but it is to be remarked that the composition of the blood is singularly uniform, considering the work it has to perform in supplying the materials for the replenishment of worn-out tissue, and the carrying away of the products arising from their destruction.

4. *Gases* are oxygen, nitrogen and carbonic anhydride, free and in combination, and careful experiments show that there are 49 to 54 volumes of gas, free and combined, in 100 volumes of blood. *Relatively*, venous blood contains more carbonic acid and less oxygen than arterial; but, *absolutely*, the carbonic acid, in both arterial and venous blood, is always in excess of the oxygen.

COMPOSITION 1000 PARTS OF BLOOD CORPUSCLES.

Water.....	688.00
Solid constituents consisting of—	
Globulin and cell membrane, or stroma.....	282.22
Hæmatin (with iron).....	16.75
Fat.....	2.31
Extractive matters.....	2.60
Mineral matter (without iron).....	8.12
Consisting of—	
Chlorine.....	1.686
Sulphuric acid.....	0.066
Phosphoric acid.....	1.134
Phosphate of lime.....	0.114
Phosphate of magnesia.....	0.073
Potassium.....	3.828
Sodium.....	1.052
Oxygen.....	0.667
	— 312.00
	1000.00

LIQUOR SANGUINIS (Sp. Gr. 1028).

Water	902.90	
Solid constituents, consisting of—		
Albumen.....	78.84	
Fibrin	4.05	
Fat.....	1.72	
Extractive matters.....	3.94	88.55
Mineral matter, viz:		
Chlorine	3.644	
Sulphuric acid.....	0.115	
Phosphoric acid ...	0.191	
Phosphate of lime	0.311	
Phosphate of magnesia.....	0.222	
Potassium	0.323	
Sodium	3.341	
Oxygen.....	0.403	8.55
		1000.00

I. *Sensible and physical properties:* The blood is a viscid red fluid. As regards its *color* we have already noticed that this is dependent on the presence of red corpuscles, and not upon any coloring matter actually existing in a state of solution in the liquid portion or liquor sanguinis. The exact color of the blood varies :

(1.) It differs according to its source. Thus, the blood in the arteries is florid red, that in the veins being dull purple. This difference of color was at one time supposed to be physical, and due to alterations in the capacity (dependent on change of shape) of the red corpuscles for reflecting and transmitting light. It is no doubt true that the more spherical the globules, or, in other words, the more swollen the corpuscles are with water, the darker colored is the blood. Hence it was taught that carbonic acid effected the expansion of the cells, thereby rendering them bi-convex and the blood dark colored, whilst oxygen effected the contraction of the cells, thereby rendering them bi-concave and the blood bright red. It is, however, quite evident that the color change is not simply physical, but chemical, and dependent on the state of oxidation of the hæmoglobin or blood-coloring matter. Thus, in arterial blood the hæmoglobin is oxidized and of a scarlet color, whilst in venous blood a part of the hæmoglobin is deoxidized and of a purple color. Possibly the physical condition of the corpuscles, and also the presence of carbonic acid, may be elements in the case; nevertheless, there can be but little doubt that the change of color is primarily, if not entirely, due to the oxidation and deoxidation of the hæmoglobin.

(2.) The quantity of hæmoglobin in the corpuscles, as well as the proportion of corpuscles to serum, influences the color of the blood.

(3.) The form of the corpuscles (See page 185). Thus the more spherical the corpuscles, the darker the blood appears.

(4.) The thickness of the cell-wall of the corpuscles. Mulder supposed this to be the cause of the different colors of venous and arterial blood. He pointed out that potassic nitrate and iodide, and also sodic phosphate and carbonate, thicken the external membrane of the corpuscles, and render the blood a lighter color.

(5.) Any reagents, like the caustic alkalies and certain organic acids that burst the corpuscles, render the blood brownish-red.

The odor of blood is more marked when warm than when cold. By treating the blood with sulphuric acid, the odor becomes so apparent that it is often possible to name the animal from which the blood so treated was derived. The odor is more intense as well as marked in the blood of males than in that of females. It is supposed that this odor is due to a volatile fatty acid.

Specific Gravity: Normal blood has a specific gravity varying from 1052.0 to 1057.0. It is less in women, and especially in pregnant women than in men, and least of all in children. The specific gravity of venous blood is always somewhat higher than that of arterial. The blood from various animals, so far as the specific gravity is concerned, varies very little. The blood of the bullock was found to have a mean gravity of 1060.0, and that of sheep (seven experiments) 1053.0 (Tidy).

The *temperature* of the blood is usually 100 degrees F. (37.8 degrees C.), but the blood on the left side of the heart is said to be one to two degrees F. higher than the blood on the right side, whilst the blood is warmed by passing through the liver and cooled by passing through the superficial capillaries.

Chemism: The blood has invariably a slightly alkaline reaction when first drawn from the body, but it becomes acid after a short time, owing it is supposed, to the conversion of the sugar into lactic acid. Menstrual blood is said to be acid, but this is probably due to its intermixture with acid uterine or vaginal mucus.

Coagulation: In from two to five minutes after the blood is drawn from the body it coagulates, and in from seven to fourteen minutes the whole mass becomes gelatinous. This coagulation is due to the fibrin present in a soluble state in living blood becoming insoluble in dead blood. The cause of this change is not fully understood. It has been suggested that it is due to the contact of foreign matter with the blood when it is drawn from the body. Others suppose that the inherent tendency of the fibrin to coagulate, is prevented during life by some inhibitory power resident in the walls of containing vessels. Others sup-

pose that coagulation of the fibrin does take place in the body, but that the tissue needing it absorbs the coagulated mass as soon as formed. Others believe coagulation is due to the escape of ammonia and carbonic acid when the blood is withdrawn from the body; whilst others hold (Schmidt and Buchanan) that the fibrin is not present at all in living blood, but that coagulation results when the blood is drawn, from the actual formation of fibrin by the union of two substances existing separately in the fluid and living blood. The solid mass now gradually contracts, forcing out a watery fluid for twelve to forty hours, or until coagulation is complete. (See putrefaction.)

Blood corpuscles, or globules (See pp. 78-80), may be separated from the plasma by receiving fresh blood in a saturated solution of sodium sulphate, and filtering which leaves the globules on the filter. Placed in contact with water, they absorb the same, swell and become spherical, while at the same time their hæmoglobin extravasates and colors the water; hence blood globules cannot be washed with pure water without alteration, and hence the use of the sulphate of soda solution (18° B.) suggested above.

Red globules treated with water become spherical and distended, the coloring matter and other elements pass into the water, and there remains a gelatinous mass of a pale tint called *stroma*, which is formed chiefly of albuminoid substances. The specific gravity of the red corpuscles is, on the average, about 1.088, but is influenced by disease and other causes.

The white corpuscles (See page 81) are also distended but not destroyed by water, or only after a long time; acetic acid contracts, and it should be remembered that these white corpuscles are found in other fluids of the body as well as in blood.

ANALYSIS OF DRIED GLOBULES (MIXED).

	Human blood.	Blood of a dog.
Hæmoglobin	86.79	86.50
Albuminoid matter.....	12.24	12.55
Lecithin	0.72	0.59
Cholesterin.....	0.25	0.36

(Hoppe-Seyler.)

CHEMISTRY OF THE BLOOD CORPUSCLES.

The albuminoid matters appear to be constituted chiefly, if not wholly, of globulins.

1. *Globulin* is a substance similar in composition to, and in its properties closely resembling, albumen. It is found in large quantity

(ten to fourteen per cent) in the crystalline lens, and for this reason is sometimes called *crystallin*. (See Albumens.)

2. *Hæmoglobin*. *Synonyms*: *Hæmatoglobuline* (Simon), *Hæmato-crystalline* (Lehmann), *Chromatine*, *Oxyhæmoglobin*, *Erythrocrucarine*.

This is the true, and the only coloring matter of the blood of vertebrate animals. Its percentage composition is stated as follows:

Carbon	54.2
Hydrogen	7.2
Nitrogen	16.0
Oxygen	21.5
Sulphur	0.7
Iron	0.4
	100

The color of hæmoglobin depends upon its iron. About the middle of the last century, Vecentius Menghini published in the transactions of the academy of science of Bologna, an account of the experiments which establish this fact. In this account he is the first to state that, after washing the coloring matter from crassamentum, and separating it from the water by boiling, the coloring matter rises to the surface of the water, or subsides and leaves the water clear. After drying with a gentle heat, some of the coloring matter thus separated, and then repeatedly washing it, he found that it contained a considerable quantity of iron, which was attracted by the magnet. After exposing a large quantity of the coloring matter to an intense heat, he found in it a small piece of iron, of a spherical form, but hollow; and a powder which was attracted by the magnet, but appeared more like rust of iron than iron filings.

The seat of this iron is proven to be in the coloring matter of the blood, as neither the serum nor fibrin contain it. According to his calculations, the blood of a healthy adult contains about two ounces of iron in its hæmoglobin.

Hæmoglobin is the principal constituent of the red corpuscles of the blood of vertebrate animals. In man, the dog, pig, ox, and many other animals, the red corpuscles are almost pure hæmoglobin, only traces of other substances being present; while in birds, this coloring matter is associated with an albuminous substance. Healthy human blood contains, on an average, twelve percent of hæmoglobin; but it must be remembered that the amount varies at different times of the day, and with other circumstances influencing the normal periodic changes of the individual. Arterial blood contains a somewhat larger amount than venous blood. In a person suffering with cholera, the blood, on account of its concentration, contains a much larger per cent of hæmoglobin than is normal; while in leucocythæmia the per cent is decreased. (Hofmann.) Hæmoglobin is more abundant in carnivora than in herbivora, in the

adult than in the young, and in the fasting than in the recently fed animal.

Hæmoglobin exists not only in the blood corpuscle, but also in some muscles, and in solution in the blood of some invertebrates, as, for instance, in the angle-worm. Amorphous hæmoglobin can be separated from the blood of man; crystals of hæmoglobin are obtained with difficulty; while the blood of the dog, cat, rat, goose, and many other animals, readily yields the crystalline form.

Preparation: Hæmoglobin may be prepared by mixing defibrinated blood, with an equal volume of water, and adding to the liquid one-quarter its volume of eighty per cent alcohol, and allowing the mixture to stand for twenty-four hours at 0°. Crystals then form in the liquid which must be removed by filtration, purified by solution, in pure water from which it may be obtained in crystals by a repetition of the process described above.

Properties: Hæmoglobin may be obtained from blood, with more or less ease, in a crystalline form (Hæmato-crystalline of Funke.)

The forms of the crystals vary in different animals. Thus they are:

(a.) Prismatic in the blood of fish, in human blood, and in the blood of most animals.

(b.) Tetrahedral in the blood of the rat, mouse, and guinea-pig.

(c.) Hexagonal in the blood of the squirrel.

The formation of hæmoglobin crystals is promoted by light, and by the chemical action of oxygen and carbonic acid on the corpuscles. It is especially to be noted that the crystals are not the result of the evaporation of the water of the blood, inasmuch as they are formed more readily when the blood is diluted with twice its volume of water than when only mixed with one-half its volume.

Hæmoglobin is soluble in cold water, but not in hot. The prismatic crystals are soluble in 94 parts of cold water, the solution coagulating at 147.2 degrees F. (64 degrees C.) while the tetrahedral crystals are soluble in 600 parts of cold water, the solution coagulating at 145.4 degrees F. (63 degrees C.) This coagulation consists not only in the coagulation of the albumen, but in the formation of hæmatin. The red solution is decolorized by chlorine, with the precipitation of white flakes (the chloro-hæmatin of Mulder) and is changed to a brownish red color by carbonic oxide, and to a brown color by nitrogen. It may be said generally, that whatever precipitates hæmoglobin, destroys it. The feeblest acids, even carbonic, decompose it.

The crystals of hæmoglobin, as well as an aqueous solution of the same, have the bright red color of arterial blood. The aqueous solution gives a feebly acid reaction, and is decomposed, with the formation of an

albuminous substance which coagulates, on being heated to sixty-five degrees.

The crystals of the aqueous solutions of hæmoglobin contain oxygen, which is loosely held in combination, and which may be removed by means of the air-pump, or by various reducing agents. This oxygen is not reckoned in the ultimate analysis of this coloring matter, which has already been given. The term, *Oxyhæmoglobin*, is often used to designate this substance as it holds the oxygen, and in contradistinction to the hæmoglobin from which this oxygen has been removed. After the removal of the oxygen, the coloring matter dissolves more readily in water, but does not recrystallize, or does so with great difficulty. The amount of this loosely combined oxygen which may be freed is constant; *e. g.* measured at a pressure of one metre, the oxygen given off from one gram. of pure crystals occupies 1.34 c.c.

If now an aqueous solution of oxyhæmoglobin be treated with a current of nitrogen or hydrogen gas, the brilliant hue of the solution is replaced by a purple color; the loosely combined oxygen has been removed, and *reduced hæmoglobin* remains. The same effect is produced by adding to the solution of oxyhæmoglobin reducing agents, as the alkaline sulphides, ammoniacal solutions of tartrates (as tartaric acid added to a solution of ferrous sulphate, until a precipitate no longer occurs on the addition of sodic hydrate, and then the whole made alkaline with ammonic hydrate), finely divided tin or other metals.

The spectroscope reveals the fact that arterial blood contains much oxyhæmoglobin, and but little reduced; and when all the oxyhæmoglobin disappears from the blood death follows from asphyxia. (See poisons.) As the blood leaves the left side of the heart, nearly all of its hæmoglobin exists in the oxidized condition, but during its passage through the arteries and capillaries this becomes reduced. If a solution of this reduced hæmoglobin be shaken with air, oxygen is reabsorbed, and oxyhæmoglobin is again formed, as is proved by the change of the solution from purple to scarlet, and the difference of its lines in the spectroscope, which shows most delicately the difference between the two substances.

Besides oxygen, hæmoglobin unites with other substances in a similar manner, and it must be remembered that the association of these substances with hæmoglobin does not apparently break up the arrangement of its molecule (Vaughan). Carbonic oxide, nitrogen dioxide and cyanhydric acid are among the substances which act this way, as may be proven by treating a warm, concentrated aqueous solution of oxyhæmoglobin for a short time with a current of carbonic oxide (CO); the oxygen will be liberated and an equal volume of the other gas will be taken up. Cool the solution to 0°; add one-fourth its volume of cold alcohol;

allow to stand for twenty-four hours, exposed to a temperature at or below the freezing point, when beautiful, purple colored, four-sided prisms of this compound will appear. These crystals are more permanent and less freely soluble in water than those of oxyhæmoglobin.

This combination of carbonic oxide with hæmoglobin is stronger than that of oxygen with the same; thus, while oxygen is readily removed from oxyhæmoglobin by a current of carbonic oxide, the latter is but slowly freed from its compound by being treated with oxygen gas. Continued agitation with oxygen converts carbonic oxide-hæmoglobin into oxyhæmoglobin; probably the carbonic oxide (CO) is first changed into carbonic acid (CO₂).

An insoluble form of hæmoglobin is sometimes found in cysts, etc. To this the name of hæmatoidrin, or methæmoglobin has been given. It is found in blood after decomposition, in the brown fluids of hydrocele, and ovarian cysts as a brick red deposit, consisting of corpuscles insoluble in water and alcohol, and permanent at ordinary temperatures, but decomposed by acids and alkalis. Chemically it appears to be a body intermediate between hæmoglobin and hæmatin next to be considered.

Hæmatin. By the action of heat, or of mineral and other acids, and also of alkalis, etc., hæmoglobin is converted into hæmatin (hæmato-sin) (C₆₈H₇₀N₈Fe₂O₁₀). This body, which contains 12.8 per cent of iron oxide, and was once supposed to be a constituent, and the true coloring matter of the red corpuscles, is now proved to be merely a product of the decomposition of the hæmoglobin.

Hæmatin is an amorphous, blackish-brown substance, without taste or color. It is insoluble in water, alcohol, ether, acetic ether, in all oils, or even in the concentrated mineral acids; whilst it is soluble in alcohol acidulated with either sulphuric or hydrochloric acid, and in aqueous or alcoholic solutions of the alkalis or of their carbonates. The brown acid alcoholic solution, when treated with an alkali, appears red by reflected, and green by transmitted light. It is decomposed by chlorine and by boiling with nitric acid.

Hæmatin is frequently found in old blood extravasations and in the intestines. In the former case it comes from the decomposition of hæmoglobin, and in the latter from the action of the gastric juice upon the blood contained in food. It also appears in the urine in certain diseased conditions of the kidneys and after arsenical poisoning. Hæmatin is precipitated from alkaline solutions by chloride of barium; and by the action of common salt and glacial acetic acid is converted into hæmatin hydrochloride, or Teichman's hæmin crystals. These are used as a test for blood, and are prepared by adding to a cold, aqueous solution of blood a few drops of glacial acetic acid and cautiously evaporating until small, rhombic, brownish-black crystals are obtained. These are insol-

uble in water, alcohol, ether and chloroform; soluble in alkalies and in alcohol acidulated with sulphuric acid.

BLOOD PLASMA AND SERUM.

Concerning blood plasma, Vaughan very happily says: "The principal office of the red corpuscle is to serve as a vehicle for carrying oxygen to the various tissues of the body; but there must be some agent to convey the corpuscle, to bring to the tissues material for repair and to remove the debris. Oxygen alone can not support life; there must be something to combine with the oxygen in order to produce animal heat. Moreover, this combustion must go on in every part of the body; even if it be true that the solid tissues enter but little into those chemical changes whereby life is supported, it is still necessary that combustion should take place in every organ. Let us suppose that the blood as it leaves the heart contains all of the oxygen and all of the material to be consumed, still life could not be maintained did this oxidation become complete immediately, or take place in one organ only; the muscles of the arm and of every other part of the body alike need the production of heat within themselves before they can contract and relax; the brain requires combustion within its substance, whether of its substance or not, before it can act. The plasma serves as the channel for the transmission of the material which supports life and of that which is the product of decay. It is, as Bernard said, the internal medium which bears the same relation to the tissues as the external medium, the world, does to the individual. The composition of the plasma is necessarily very variable: at one time it may be bearing that which strengthens the body and elevates the mind; at another time it may contain poisons which injure both body and mind."

Blood plasma, or liquor sanguinis, kept at a temperature below 0° is a viscid, yellowish, strongly alkaline fluid; but when the temperature is allowed to rise above that, the plasma is slowly transformed into a jelly-like mass, which gradually contracts and presses out a fluid to which the name of serum has been given. The serum of the blood is then the liquor sanguinis, or plasma minus its fibrin.

Properties: A straw colored fluid in health, becoming, in certain diseases, such as icterus and pneumonia, of an intensely yellow color. Its average specific gravity is 1.028, and, in this respect is singularly uniform. Its reaction is alkaline, the alkalinity being due to the presence of carbonate and phosphate of soda. Blood serum is also straw-colored and alkaline. It coagulates at 170 degrees F. (76.1 degrees C.)

Water.—The quantity of water in blood varies. Thus there is more in the blood of women (especially during pregnancy) than in that of men, and more in those of advanced age than in the young. The pro-

portion present is influenced by disease. Thus there is a great diminution in the quantity of water in the blood in cholera. And further, arterial blood contains more water than venous blood, while in both venous and arterial blood the actual proportion of water varies hourly with the food, exercise and atmospheric changes. Nevertheless, a remarkable uniformity is noticeable, for that which lessens the water excites thirst; while, if an excess of water be added to the blood, the urine and sweat get rid of it.

Albumen.— $C_{72}H_{112}N_{18}SO_{32}$. This varies from 60 to 70 parts per 1,000 of blood. It is the cause of the coagulation of the serum by heat. It may be obtained in a soluble state by evaporating the serum below 120 degrees F. (48.9 C.), while, if the serum be evaporated at a higher temperature, the albumen becomes insoluble in water at ordinary pressure. (See Albumens.)

Seyler considers that the albumen is not present in blood in a state of solution, but merely in a state of fine subdivision. Others believe it to be present as an albuminate of soda, while Enderlin believes it to be held in solution by the sodic phosphate. The blood of women contains more albumen than the blood of men, while arterial blood contains less albumen than venous. The quantity of albumen in the blood is decreased in such diseases as Bright's disease, scurvy, puerperal fever, etc., while it is increased in cholera, intermittent fever, etc.

Fibrin, once supposed to be held merely in solution in the blood, is now generally believed to be formed by the reaction of two other substances to which the names of fibrino-plastin, or paraglobulin, and fibrinogen has been given. Fibrin may be readily obtained from blood by whipping it with twigs, on which the fibrin forms in fine, white shreds; its quantity, on the average, is between two and three parts in 1,000. It is usually increased in inflammatory affections, as rheumatism, pneumonia, etc., and decreased in anæmic diseases, as typhus, chlorosis, etc. Its spontaneous and speedy coagulation distinguishes it from all analogous substances. This property of coagulation is thought by Denis to be due not to fibrin, but to a substance named by him plasmin, upon which the coagulation of blood plasma evidently belongs; but plasmin has been proven to be a compound body, for neither serum nor effused serum, clots when kept separately; but if the two be mixed, coagulation occurs just as it does in plasma. Thus, if some filtered hydrocele fluid be kept at from 38° to 40°, no coagulum appears, and the fluid will remain clear until decomposition takes place; but, if a little blood serum be added, the mixture soon clots. Plasmin then is a compound containing at least two substances, one of which is present in serum and the other in hydrocele fluid. By the labors of A. Schmidt each of these has been isolated, and the one from serum is known as fibrino-plastin, paraglobulin,

or fibrino-plastic globulin; while the one from hydrocele fluid is known as fibrinogen. Both of these are present in plasma, and the plasmin of Denis is a mixture of fibrino-plastin and fibrinogen.

Fibrinoplastin is insoluble in pure water, but is soluble in water containing much oxygen and in dilute solutions of sodic chloride or phosphate. Dissolved in the above solutions, fibrinoplastin retains its active properties; so that if such a solution be added to hydrocele fluid, coagulation will take place. It is also soluble in acetic acid, but solution by this solvent destroys the activity of fibrinoplastin.

Fibrinogen resembles very closely paraglobulin and may be prepared from serous exudates by carbonic acid, just as globulin may be precipitated from the serum of the blood. When redissolved in an alkaline solution, and added to any fluid containing globulin, it acts as a coagulator of that fluid, and gives rise to the development of a clot of fibrin in it. In accordance with what has just been stated, serum of blood which has completely coagulated may be kept in one vessel, and pericardial fluid in another, for an indefinite period, if spontaneous decomposition be prevented, without the coagulation of either, but let them be mixed, and coagulation sets in.

Thus it seems to be clear, that the coagulation of the blood, and the formation of fibrin, are caused primarily by the interaction of two substances (or two modifications of the same substance), *globulin* and *fibrinogen*, the former of which exists in the serum of the blood, and in some tissues of the body; while the latter is known, at the present, only in the plasma of the blood, of the lymph, and of the chyle, and fluids derived from them.

Fibrin is insoluble in water, alcohol and ether, soluble in dilute alkalis forming albuminates. When digested with a two per cent solution of muriatic acid, fibrin is transformed into a semi-transparent, jelly-like mass. By the action of gastric juice, fibrin is converted into peptone, the change being a chemical one and not one of simple solution. If the gastric juice contains but little pepsin the products of the digestion of fibrin with this fluid will be precipitated by neutralizing the solution. By the action of pancreatic juice, fibrin is transformed into peptone, tyrosin and leucin. Fibrin contains 52.6 per cent of C, 17.4 of N, 21.8 of O, 7.0 of H, and 1.2 of S.

Fatty matters.—The proportion of fat in blood is about 1.6 parts in 1000. The quantity is not increased by a want of fat food. Arterial blood contains less fat than venous, and the portal vein more fat than the jugular. The quantity of fat (and especially of cholesterin) is increased at the commencement of every acute disease, and also in some chronic diseases.

Most of the fatty matter present in the blood is in a saponified form.

It would appear that the fats peculiar to various organs exist ready formed in the blood, as *e. g.* cholesterin (the fat of bile) cerebrin and the phosphorized fat of the brain, together with oleic, margaric and stearic acids, chiefly Saponified but also in a free state.

These fatty matters of the blood not only supply fat where it is needed, but serve by their oxidation to maintain the temperature of the body.

Extractive matter.—This term includes creatin and creatinin, glucose, urea, uric acid, hippuric and lactic acids, and certain other bodies.

Alcohol is said to be always present in blood in minute quantity, and is supposed to be formed by the fermentation of the sugar.

Mineral matters.—The percentage composition of the ash of serum may be thus stated :

Sodic chloride.....	61.08
Potassic chloride.....	4.08
Sodic carbonate (Na_2CO_3).....	28.87
Hydriso di-sodic phosphate (Na_2HPO_4).....	3.19
Potassic sulphate.....	2.78
	100.00

The proportion of mineral ingredients is greater in the blood of adults than in that of the young, greater in arterial than in venous or jugular. The quantity is influenced by diet and by disease. There is a larger quantity present in the blood of the cat, goat and sheep than in the blood of men, birds and pigs, whilst a smaller quantity is found in the blood of dogs and rabbits than in other animals.

The iron (a never failing constituent of blood) belongs exclusively to the red corpuscles.

CHYLE AND LYMPH.

Chyle is the fluid of the lacteals, the lymphatics of the intestines. It is transparent after fasting, but milk-like during digestion. This milkiness is due to the presence of minute fatty particles termed the molecular base of the chyle. (See digestion.)

Lymph is the fluid of the lymphatics. It is a clear, colorless, faintly alkaline, albuminous liquid, having no fatty particles, such as occur in chyle in suspension. (See page 82.)

Percentage composition of lymph and chyle.

	LYMPH.	CHYLE.
Water.....	90.237	99.536
Albumen.....	3.516	1.200
Fibrin.....	0.370	0.120
Animal extractive matter.....	1.565	1.559
Fatty matter.....	3.601	trace
Salts.....	0.711	0.585
	100.000	100.000

We remark:

(1.) That lymph and chyle are substantially alike, except that chyle contains fat, and lymph none or nearly none.

(2.) Lymph and chyle are substantially, like blood, the difference being only one of degree. In fact these liquids probably are rudimental blood, containing corpuscles in process of development into red corpuscles. The difference between the lymph and chyle and the blood becomes less and less as the two former pass through the thoracic duct, or in other words as they approach the place where they are to be mingled with the blood.

(3.) Blood, lymph, and chyle agree, in that they contain fibrin and coagulate spontaneously, although the clot of lymph and chyle is softer than that of blood. Moreover, in this property of spontaneous coagulation they differ from all other animal fluids.

MILK.

Milk is a liquid secreted by the female mammary gland after parturition. Microscopically it consists of fat globules, surrounded by an albuminous envelope, having a diameter of 0.0014 inches, floating in a perfectly transparent fluid.

Composition per 100 parts of human milk compared with that of the cow. (Tidy.)

	WOMAN'S MILK.			COW'S MILK.
	<i>Max.</i>	<i>Min.</i>	<i>Average.</i>	<i>Average.</i>
Casein.....	4.36	2.97	3.52	3.64
Butter.....	5.18	4.45	4.02	3.55
Sugar of milk.....	4.43	3.29	4.27	4.70
Various salts.....	0.23	0.38	0.28	0.81
Total solids.....	14.20	11.09	12.09	12.70
Water.....	85.80	88.91	87.91	87.30
Total.....	100.00	100.00	100.00	100.00

The reaction of fresh milk is variously stated. It is probably nearly neutral or very slightly alkaline, owing to the soda holding the casein in solution (albuminate). After a time it becomes acid and then coagulates. This action is rapid if the weather be warm and the air electrical. It is occasioned by the conversion of the milk-sugar into lactic acid, under the influence of the nitrogenized body, casein, which acid effects the precipitation of the casein (lactic fermentation). The clot, containing the milk globules in mechanical admixture, constitutes "curds" and the clear liquid "whey."

Normal milk contains no albumen, but colostrum (that is, the first milk secreted after pregnancy) usually abounds in it.

Human milk has an average specific gravity of 1030.

DIGESTION.

Digestion is a process of solution, *i. e.* of rinsing or drenching the food with various secretions so as to extract from it the nutritious portions, and convey them into the circulation.

To carry out this rinsing process perfectly, the food is first, in most cases, cooked, and then chewed. In this way a perfect admixture of the materials with the various solvent agents is effected.

The following diagram represents the amount of digestive fluids secreted daily, and the proportions of their chief constituents.

	Quantity Secreted.	Solid Matters.	Active Principles.
Saliva.....	2.53 lbs.	231 grs.	116 grs. of ptyalin.
Gastric juice.....	14.11 "	2,963 "	1,482 " of pepsin.
Pancreatic fluid.....	0.44 "	309 "	39 " of pancreatin.
Bile.....	3.53 "	1,234 "	1,058 " of org. ferment.
Intestinal mucus.....	0.44 "	46 "	28 " of org. ferment.
Total.....	22.05 lbs.	4,783 grs.	2,723 grs. of special solvents.

And the second diagram explains the part performed by each in the process of digestion.

TABLE OF DIGESTIVE FERMENTS.

NAME.	FUNCTION.
1. <i>Ptyalin</i> , or salivary diastase contained in the saliva.	1. Changes starch into dextrine and glucose.
2. <i>Pepsin</i> contained in gastric juice.	2. In acid fluids changes albuminoids into peptones.
3. <i>Curdling ferment</i> contained in gastric juice.	3. Coagulates casein.
4. <i>Trypsin</i> contained in pancreatic juice.	4. In alkaline solutions transforms proteids to peptones.
5. <i>Curdling ferment</i> found in pancreatic juice.	5. Coagulates milk casein.
6. <i>Pancreatic diastase</i> found in pancreatic juice.	6. Changes starch into dextrine and glucose.
7. <i>Emulsive ferment</i> found in pancreatic juice.	7. Emulsifies fats.
8. <i>Bile</i> poured into duodenum.	8. Assists in emulsifying fats.
9. <i>Invertin</i> found in intestinal juice.	9. Converts cane sugar into interved sugar.
10. <i>Curdling ferment</i> found in intestinal juice.	10. Coagulates casein.

SALIVA.

Saliva is the fluid secreted by the various salivary glands, such as the parotid, the submaxillary, the sublingual, etc. Two to three pints in the twenty-four hours may be taken as the average quantity secreted.

The exact amount, however, varies considerably. The quantity is decreased by fasting, and increased by the stimulus of food in the mouth, or by the mere mental impression connected with the sight or even the thought of food.

Composition per 1000 parts of saliva (Frerichs):

Water		994.1
Solids	{ Organic 3.61 }	5.9
	{ Inorganic 2.29 }	
		1000.0

The organic constituents of saliva consist of an albuminoid substance called *ptyalin* which constitutes about one-fourth of the total solid mass of the saliva, together with fat, epithelium, etc. The *ptyalin* is said to be contained more largely in the saliva, secreted by the submaxillary than by the other salivary glands. The inorganic constituents consist of phosphates of lime, magnesia, and soda (the deposition of the earthy phosphates on the teeth by the action of the ammonia of the breath constituting what is called "tartar") of alkaline chlorides, and a small but an ever present quantity of potassic sulphocyanide, said to be increased when sulphur is taken internally.

Properties: Saliva is a clear, feebly alkaline fluid. Its specific gravity varies from 1002 to 1009. The alkalinity of the secretion from the parotid is said to be more marked than that from the other salivary glands. During digestion, moreover, its alkalinity is increased. In certain diseased conditions the saliva becomes distinctly acid.

(a) As a mechanical agent its action depends on the presence of the ferment body, "*ptyalin*," by which the insoluble starch is transformed into soluble dextrin and glucose. This conversion of the starch is retarded rather than promoted by the gastric juice. (b) The saliva may also, being an alkaline fluid, assist in emulsifying the fat.

GASTRIC JUICE.

The gastric juice is a fluid secreted from the glands of the stomach, under the influence of exciting causes, such as the introduction of food and other mechanical irritants, and more especially by soluble irritants, such as salts, etc. The quantity secreted in the twenty-four hours is variously stated at from 10 to 20 pints.

Composition of human gastric juice per 1,000 parts:

Water		994.4
Solid constituents	{ Organic (pepsin) 3.2 }	5.6
	{ Inorganic 2.4 }	
		1000.0

The salts present in the gastric fluid consists of calcic, sodic and potassic chlorides, and earthy phosphates.

The two important constituents of the gastric fluid are the free acid and the pepsin.

(a) As regards the free acid, some investigators maintain it to be lactic acid, and others hydrochloric acid. M. Verneuil states that he has found both acids present in a free state, the hydrochloric acid being 1.7 parts in 1,000 and the lactic acid in the proportion of 1 part of lactic to 9 parts of hydrochloric acid. The quantity of acid is increased by taking alcohol, and decreased by taking sugar.

The fact probably is that both acids are usually present, the hydrochloric, as a rule, largely predominating. In some cases, moreover, the presence of acetic, phosphoric and butyric acids has been clearly demonstrated.

(b) Pepsin is an albuminoid body, soluble in water and insoluble in alcohol. Its solution is precipitated by corrosive sublimate, by solutions of tannic acid and by lead salts, and by alcohol. When a solution of pepsin is boiled, its action as a solvent of albuminoid matter is destroyed.

Properties: The gastric juice is a clear, acid, colorless fluid. It has a specific gravity varying from 1002.2 to 1002.4. It is miscible in water. It coagulates albumen. Its action is powerfully antiseptic. Its solution does not become turbid on boiling.

The action of the gastric juice as a solvent of albuminoid matters, such as fibrin, coagulated albumen, etc., depends on the joint presence of the acid and of an albuminoid ferment body—pepsin. A certain temperature (100° F.) and a perfect admixture of the fluid and food, as *e. g.*, by mastication of the food and the muscular action of the stomach, etc., are also necessary conditions. Thus, after a time, varying from two to six hours, complete chymification of the food is effected, the fibrinous and albuminous constituents being converted into different peptones or soluble forms of albumen, such as albumino-peptones, fibrino-peptones, gelatino-peptones, etc., all of which differ from common albumen, in their solubility, in being neither coagulated by heat, acid, nor spirit, and in their capability of being dialysed (albuminose of Mialhe). The composition of the chyme depends, of course, largely on the food, but it has the general appearance of a thick fluid, consisting of a solid, undigested portion, suspended in a liquid of a more or less yellow color, and of a more or less disagreeable odor.

The gastric juice has no action on starch or fat.

THE PANCREATIC FLUID.

This fluid, which in many respects is like the saliva (but unlike it in containing no sulphocyanides), is the secretion of the pancreas, a gland closely resembling the salivary glands, but located in the abdomen.

Composition of pancreatic fluid.

Water		980.45
Solids (Pancreatin).....	12.71 g	19.55
Inorganic.....	6.84 g	
		1000.00

Properties: A colorless fluid; specific gravity, 1008 to 1009. Its reaction is usually stated as alkaline, but this, so far as the fresh fluid is concerned, is doubtful. Its action depends on the presence of an organic principle, called pancreatin, an albuminoid ferment body, constituting two-thirds of its total solids. Its action is two-fold: (1) It emulsifies fat, converting it into a milky liquid, thereby rendering it capable of absorption by the lacteals; and (2) it converts starch into glucose, and so effects its solution.

THE BILE

is the fluid secreted by the cells of the liver and in all the omnivora and carnivora is a brownish or reddish-yellow, bitter, viscid fluid whose chemical composition as given by Frerichs is as follows:

Water.....			859.2	
Solids	{	Biliary acids combined with alkalis (Bilin, etc.).....	91.5	140.8
		Fat	9.2	
		Cholesterin	2.6	
		Mucus and coloring matters.....	29.8	
		Salts (Inorganic)	7.7	
			1000.00	

It is feebly alkaline when taken from the gall bladder. Its inorganic salts are sodic chloride, calcic and sodic phosphate, oxide of iron and traces of copper. Its organic acids are mucic, cholic, glycocholic and taurocholic acids, and its chief organic compounds are cholesterin, lecithin and the bile pigments and the soda salts of its acids.

The quantity of solid matter is greater in the bile of the young than in that of the old; and is in excess in such diseases as cholera, heart-disease, abdominal plethora, etc., whilst it is less than normal in severe inflammation, diabetes, etc.

Bile consists essentially of resinoid matter, coloring matter, and the salts of its acids.

(1) Resinoid matter (Bilin). This consists of the soda or potash salts of two, or one of two, acids, one of which contains sulphur and the other none, and taurin ($C_2H_7NSO_2$).

(2) *Glycocholic* acid and its salts are found in the bile of man and the ox, but not in the dog whether fed upon animal, vegetable, or mixed food. The pure acid may be obtained in crystals which are soluble in hot and cold water and absolute alcohol, but insoluble in ether. The alkaline glycocholates are also soluble in water and alcohol; the others not so.

Cholinic acid, glycocholic acid and cholaic acid are the more important decomposition products of glycocholic acid.

(3) *Taurocholic acid*, also known as cholinic acid, is found in connection with the glycocholates in human and ox bile, from which it may be extracted in fine crystals which on exposure to the air deliquesce and become an acid syrup. Taurocholic acid readily combines with water to form cholaic acid and taurin ($C_2H_7NO_2S$).

(4) *Taurin* is found in the bile of the gall bladder combined with cholaic acid and like glycocholic acid is reabsorbed from the intestines. It may be isolated in large, colorless, four-sided prisms which are insoluble in absolute alcohol but are dissolved by dilute and hot and cold water. From its composition, especially from the fact that it contains sulphur, carbon, nitrogen and hydrogen it undoubtedly is derived from the albuminoids.

(5) *Cholesterin* ought to be mentioned in connection with the bile since it constitutes the bulk of the gall-stones, or concretions formed from bile in the gall bladder. It is a crystallizable compound which chemically resembles the fats, in that it is destitute of nitrogen, readily inflammable, soluble in alcohol or ether, and entirely insoluble in water. Its formula is $C_{26}H_{44}O$ and it is widely distributed in both the vegetable and animal worlds. It exists in peas, beans, Indian corn, and probably in all seeds. It has been found in the brain, spleen, bile, etc. It also occurs in many pathological formations such as pus, hydrocele fluid, the contents of various cysts, tubercles, and transudations of every kind. It is present in human milk, in the colorless corpuscles of the blood, and in the seminal fluid. Its existence in the human urine is due to a pathological condition, but it is a normal constituent of human feces.

(6) *Bile Pigments*. The coloring matter of the bile is termed choleochrome. This is a mixture of a green pigment, insoluble in chloroform, called biliverdin ($C_{16}H_{18}N_4O_4$) and a brown pigment, soluble in chloroform, called cholephæin. Of this latter there are two modifications, viz.: the red, bilirubin ($C_{16}H_{18}N_2O_3$) and the brown biliprasin, $C_{16}H_{22}N_2O_6$.

(7) A blue coloring matter has also been described.

The action of the bile is involved in much obscurity; it does not convert starch into sugar, like the saliva and pancreatic fluid (doubted by Wittich); it does not dissolve fibrin like the gastric juice; it does not emulsify fat, or at any rate to the same extent, as does the secretion from the pancreas.

Some regard the function of the bile as the medium, by direct excretion, for the separation of an excess of carbon and hydrogen from the blood, thereby effecting its purification. This is manifestly its purpose in intra-uterine life. Nevertheless, that it is more than a mere excre-

mentitious fluid, and plays an actual part in digestion, there can be but little doubt. Some have suggested that its function is to emulsify fat; others that it assists the absorption of fat by moistening the intestinal mucous membrane; others that it neutralizes the acid peptones from the stomach; others that its antiseptic power prevents the decomposition of the food as it passes through the bowels; others that it acts as a natural purgative by its stimulating effect on the intestines. The liver doubtless performs more than one function, and some of these will be discussed more at length under the head of poisons and poisoning.

INTESTINAL JUICE.

From the duodenal fluids a ferment can be obtained by extraction with glycerine, which bears a close resemblance to, and probably is identical in composition with the *succus pyloricus*. It is strongly alkaline, and on being acidified with hydrochloric acid digests fibrin. Intestinal juice also possesses two other ferments, by means of which it converts starch and cane sugar into grape sugar. The secretion of the large intestines is also alkaline, is tenacious, turbid, contains albumen and is, outside of the body without action upon starch, albumen or fat. The food as it enters the large intestine has an acid reaction due to fermentation as may be proven by the nature of the intestinal gases which vary in kind and amount with the food. The secretions of the small intestines are alkaline and contain three-fourths of a per cent of solid matter.

According to Bidder, flesh and albumen coagulated by heat, and inclosed in the intestines by ligature, soften, dissolve, and are digested; consequently, the intestinal fluid completes the digestion of nitrogenous substances. Thiry found in pure intestinal fluid from a dog:

Water.....	97.585
Albuminates.....	0.802
Other organic substances.....	0.734
Inorganic substances.....	0.879
	100.000

The gases of the smaller intestines are chiefly carbon dioxide and hydrogen. In the larger intestine these gases are mingled with methane, and traces of hydrogen sulphide; the methane amounts to as high as 50 per cent of this volume when the food is vegetable.

Recapitulation: Perfect digestion requires normal secretion on the part of the salivary, pseudo-follicular, peptic and Brunner's glands as well as the presence of bile and pancreatic juice. The part performed by each of these is well shown in the table on page 497—but it would be well to reconsider the disposition of each kind of food again at this point.

(a) *The Inorganic* salts as a rule *pass through* and leave the system in the form in which they entered it.

(b) *The Fats*, or oleaginous hydrocarbons are digested by the aid of the pancreatic juice, mainly in the small intestines, though its action is assisted by the secretions of Brunner's glands and the bile.

(c) *The Saccharine carbohydrates* by the action of ptyalin and the intestinal ferments are converted into assimilable glucose and inverted sugar.

(d) *The Nitrogenous* or Albuminoid foods are converted into peptones (See table, page 181) which are chemically hydrated albumenoids, or hydroxyl-albuminates prepared by the action of pepsin and trypsin on vegetable and animal fibrin, albumen, etc. They contain relatively less carbon and more hydrogen than the albuminoids from which they are derived and their other differences are well shown in the annexed table :

PEPTONES.	ALBUMEN.
1. Unaffected by heat.	1. Coagulates at 72°.
2. Not coagulated by mineral acids.	2. Mineral acids coagulate.
3. Not coagulated by alkalis.	3. Alkalis coagulate.
4. Trommer's test gives reddish violet fluid.	4. Trommer's test gives violet fluid.

EXCREMENTITIOUS PRODUCTS.

The feces consist of undigested parts of the food and mixed with secretions and transudations more or less changed by the various physical and chemical agents to which they have been subjected. The proportion of the feces to the food varies with the kind of the latter, the condition of the digestive fluids and the movements of the intestines. Normally, the feces of man are equal in weight to about one-eighth of the food.

The color of the feces varies with the food and with the action of the liver. After a meal consisting of flesh, the feces are dark brown; while after an exclusive milk diet they are yellow. When the biliary secretion is arrested, the feces are light colored, and when this secretion is excessive, they may be dark or green. In many diseases the color of the excrement is decidedly changed; thus in diarrhea, the stools are light colored and, in obstruction of the bile duct, may be perfectly colorless. From the feces traces of unchanged bile-pigments may often be obtained. Hæmatin is frequently present and in carnivora comes from the flesh of the food and, in any animal, may be present from bleeding of the walls of the alimentary canal. Only when the bleeding is in the lower part of the large intestine, is unchanged blood present in the stools.

The odor of the stools is due to *indol*, valerianic or butyric acid and hydric sulphide. Normally, the odor is due to indol, C_8H_7N . This

substance is obtained as a final product in the reduction of indigo: it is a weak base, forms large colorless crystalline plates, which are freely soluble in hot, sparingly, in cold water. Indol is often formed during pancreatic digestion, but is supposed to be due to the presence of bacteria, since its formation is arrested if the pancreatic digestion be carried on in the presence of salicylic acid. Indol is recognized by its odor and by its reaction with nitrous acid. With this acid even very dilute solutions of indol produce a red color.

Normally, the reaction of the feces is neutral or alkaline; but in certain diseased conditions, it is acid. The amount of solids varies from 174 to 317 parts in a thousand. The solids consist of earthy salts, excretin, taurin, cholalic acid, dyslysin, and according to the earlier authors stercorine, which seems now to be modified cholesterin. (See page 201.)

THE URINE,

or *the urines*, as the French very properly call it, is the liquid sewerage of the body, consisting of its soluble nitrogenous refuse besides the excess of fluid present in the blood.

About sixty ounces may be taken as the average quantity of urine secreted by an adult in twenty-four hours; but this is subject to great variation, depending on such causes as the quantity of fluid taken, the season of the year, and the relative activity of the skin, lungs and alimentary canal.

Average composition of normal urine, and average quantity of the various constituents excreted in twenty-four hours (Kirkes).

Constituents per 1,000 parts.	Average quantity excreted in twenty-four hours (adult male).
Water.....	967.000 52.0 ounces.
Urea.....	14.230 512.4 grains.
Uric acid.....	0.468 8.5 "
Extractives, pigment, mucus.....	10.167 161.0 "
Salts.....	8.135 425.0 "
Silica.....	traces traces.

The composition and character of the urine of different animals varies. Thus in the carnivora, the urine is usually clear and acid, containing much urea and but little acid. In the herbivora it is usually turbid, and alkaline, containing urea like the carnivora, together with a great excess of hippuric acid but no uric acid: it also contains an abundance of the earthy carbonates (hence its turbidity), and but very little of the earthy phosphates, these latter being proportionately abundant in the feces.

Thus it would seem that in animals that drink freely, the nitrogen is excreted as urea, whilst in those that drink but little, it is excreted as

uric acid. It must be noted, however, that these differences are differences for the most part of diet simply. For, if a carnivorous animal (as a dog) be fed on purely vegetable diet, or a herbivorous animal (as a rabbit) on a purely animal diet a corresponding change in the urine results.

(2.) The composition of the urine varies greatly in disease, thus the quantity of uric acid is increased in gout, etc.; albumen occurs in Bright's disease, etc., sugar in diabetes, etc.

(3.) The composition varies hour by hour. The morning urine (*urina sanguinis*) consists chiefly of the products of tissue decomposition. The day and evening urine is greatly influenced by the quantity and the character of the food digested (*urina cibi*) and water drunk (*urina potus*).

(a.) The kidneys secrete certain bodies from the blood in an unaltered state, *e. g.*, many metals (such as, Sb, Bi, Cu, Cr, Au, Fe, Li, Pb, Hg, Ag, Sn, Zn,) free organic acids, alcohol (?), numerous salts, many of the alkaloids, such as morphia, strychnia, atropine, etc.

(b) In other cases, the products secreted are oxidized products, or are otherwise changed. Thus ammonia salts are converted into nitrates; sulphur, alkaline sulphides and sulphites, become sulphates; tannic becomes gallic acid. The neutral salts of organic acids become carbonates; free iodine is excreted as an alkaline iodide; ferrocyanides become ferricyanides; indigo blue becomes indigo white; benzoic, cinnamic, and other acids are found in the urine as hippuric acid, etc.

Properties: (a) Physical.—A clear, yellow fluid, having a mean specific gravity in health of 1020. Its color, however, may vary even in health from a colorless liquid to a deep orange. Variations in specific gravity occur in health ranging from 1015 to 1025, depending on the season of the year, diet, exercise, etc. In disease the variation is much greater, being sometimes as low as 1005, as in albuminuria, or, as high as 1060, as in diabetes. Of its relative clearness, it is to be noted, that in health it often becomes turbid on cooling, due to the deposition of phosphates. The cause of its peculiar odor has not been well made out. The odoriferous principle, whatever it may be, undergoes speedy change.

(b) Chemical.—Healthy urine is generally acid. The acidity of the 60 ounces, voided in the twenty-four hours may be taken as equivalent to about the acidity of 30 grains of oxalic acid. This acidity, which is less during digestion (and, indeed, after a meal the urine may even be alkaline) and most marked during fasting, is due to the acid phosphate of sodium, and according to some observers, to certain free acids, such as lactic acids.

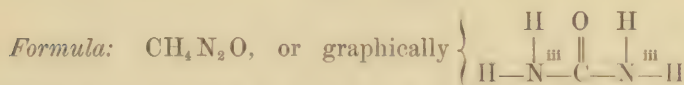
After a certain time, varying from a few days to two weeks, the urine becomes alkaline. This alkalinity is due to the urea becoming converted into carbonate of ammonia, crystals of triple phosphate, confervoid

growths and vibriones occurring simultaneously in the urine. Indeed, this change may be so rapid that under certain morbid conditions, as in cases of retention, it takes place in the bladder itself, thus rendering the urine turbid and alkaline when voided. The urine may, however, under certain conditions, be alkaline when secreted. This occurs when neutral alkaline salts of the vegetable acids have been administered, the acid being destroyed in the process of respiration, whilst the alkali appears in the urine as a carbonate.

CONSTITUENTS OF THE URINE.

(1) *Water*. This varies according to season, exercise, drink, condition of nervous system, etc. Thus it is increased in diabetes, and decreased in albuminuria, in febrile affections, by other channels, etc.

(2) UREA.



Occurrence: Urea is the chief method for the excretion of the nitrogenous refuse of the body, constituting on an average nearly one-half of the solids of the urine, but varying somewhat with diet and exercise, especially the former. It is greatest when the diet is largely animal, and least with a vegetable one, and larger in amount in middle life than in either youth or old age. Urea has also been found in various pathological transudates, as amniotic fluid, the aqueous humor, lymph and chyle.

Preparation from Urine: Evaporate the urine to a syrup, and mix the concentrated liquid with an equal bulk of nitric acid. In this way a quantity of nitrate of urea will be formed. Dissolve this compound in boiling water, and treat the solution with baric carbonate, when pure urea remains in solution. Or it may be artificially prepared from ammonium cyanate (NH_4CON), or carbonate. Artificial urea is interesting as being the first organic compound manufactured outside of the body. Urea is a colorless, inodorous body, crystallizing in long, flattened prisms. It is soluble in spirit (1 in 5 at 50°F .), and very soluble in water (1 in 1 at 60°F .), the solution being neutral and permanent. Its rapid decomposition in the urine is due to its change into ammonic carbonic (to which the ammoniacal odor of putrid urine is due), and depends on the mucus present in the urine. When heated it melts, and finally decomposes, evolving ammonia and ammonic cyanate, and leaving a residue of cyanuric acid. It forms salts with acids, such as the nitrate of urea, an important compound, on account of its difficult solubility in nitric acid. When boiled with solution of caustic alkalis (cold solutions being without action upon it), it is resolved into ammonia and alkaline car-

bonates, a similar result occurring when urea is fused with the alkaline hydrates, or heated with water in a sealed tube. It combines with metallic oxides, and is decomposed by nitrous acids or chlorites.

(3) *Uric acid*—Lithic Acid— $C_5N_4H_4O_3$. This is present in the urine in combination with soda and ammonia, and is probably derived from the disintegrated elements of albuminous tissues. The salts of uric acid, being more soluble in warm than in cold water, are frequently deposited as the urine cools, a reaction occurring in certain deranged states where an excess of uric acid is present. The quantity of uric acid in human urine is increased by an animal and decreased by a vegetable diet. It is increased in certain morbid states of the system. It varies greatly in different animals. In the feline tribe uric acid is often entirely replaced by urea. In birds and serpents the urea is often entirely replaced by uric acid. This suggests the notion that although urea and uric acid may have different origins and different offices, nevertheless that each may do the work of the other.

Pure uric acid is a perfectly white, odorless and tasteless powder, but if crystallized out of urine, it carries some of its coloring matter with and is deposited in reddish brown crystals. These crystals are insoluble in alcohol, cold dilute acids, and practically so in water (1 in 14000 cold, or 1800 boiling). Uric acid is readily soluble in potassic or sodic hydrate forming readily soluble urates with them, which with the corresponding ammonia salts are the forms in which it is usually met with in the urine.

Physiology: Uric acid is by many chemists regarded as one of the intermediate steps in the oxidation of nitrogenous foods for its final excretion as urea. Hence an increase of nitrogenous food with diminished oxidation increases uric acid. Vaughan sums up the evidence thus:

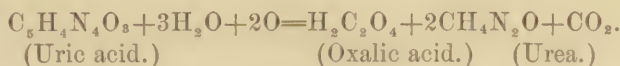
“That deficient oxidation increases the amount of uric acid and correspondingly decreases that of urea is proven by every fact which we know concerning the variations of the amounts of these substances. Wine drinking increases the quantity of uric acid, because the alcohol is more readily acted upon by the oxygen of the oxyhæmoglobin and the nitrogenous constituents of the food escape combustion. Again, constant drinking of wine leads to disease of the liver, and this organ plays an important part in splitting the albumen of our food into carbohydrates, urea and uric acid. Again in diseases of the lungs, when but an insufficient supply of oxygen reaches the blood, the quantity of uric acid is increased and that of urea correspondingly decreased. In venous stasis, the same result follows, because the blood is not oxidized sufficiently. In indigestion the processes of retrograde metamorphosis are retarded and the nitrogen leaves the body just so much farther removed from urea. Those living in poorly ventilated houses excrete an excess of uric acid and

oxalate of lime; the same is true of those who take but little physical exercise."

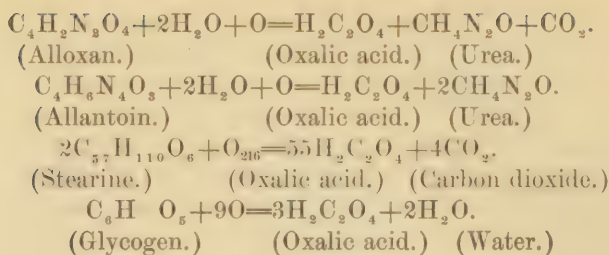
(4) *Hippuric acid*— $C_9H_9NO_3$ —is another of the constituents of normal urine where it is found in small quantity, especially after eating plums or cranberries, and the administration of certain medicines, as benzoic acid, etc. It may be separated from uric acid, with which it is usually precipitated, by the ready solubility of hippuric acid in alcohol acidulated with hydrochloric acid in which uric acid is not soluble. Hippuric acid is sparingly soluble in cold water and ether, and freely so in alcohol.

(5) *Cystine*, $C_3H_7NSO_2$, is remarkable as being the only organic constituent of urine which contains sulphur. It is usually met with in calculi only, but occasionally is found as a sediment or dissolved in the urine. It is probably an intermediate step in the formation of sulphuric acid by the oxidation of the sulphur of the tissues. In some diseased conditions of the liver, crystals of cystine are found in it, and in its composition resembles taurin (See page 201). In this connection ought also to be mentioned *xanthin*, xanthic oxide or uric oxide, $C_{10}H_4N_4O_4$, first discovered in 1817, by Dr. Marcet, in a urinary calculus, and later by Stromeyer, Leibig, etc. Chemically xanthin differs from uric acid only in the loss of two atoms of oxygen, and according to Sherer is a natural constituent of the urine, and although by four observers only found as a urinary deposit. Pure xanthin appears as brittle, chalky crusts with slight yellowish tinge, becoming waxy when rubbed. Soluble in alkalis, also moderately soluble in warm concentrated HCl, which solution becomes turbid on cooling and deposits quadratic crystals. Soluble without effervescence in HNO_3 and yields on evaporation a bright yellow residue, which becomes violet-red with KOH. Xanthin, hypoxanthin, guanin, tyrosin, leucin, creatin, creatinin, are all immediate steps in the oxidation of nitrogenous substances on their way to urea, uric acid, water and carbonic acid.

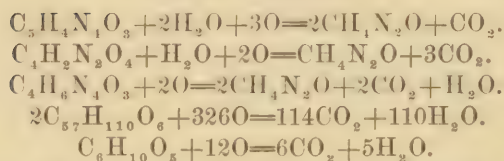
(6) *Oxalic acid* and the oxalates are still other products in the oxidation of many organic substances, and hence are frequently found in the urine when imperfect oxidation is taking place, as shown in the following equation:



Allantoin, alloxan, alloxantin, alloxanic acid and other compounds are oxidation products of uric acid (See putrefaction); and, like uric acid, yields oxalic acid with partial oxidation, whereas with perfect oxidation they would be converted into urea, carbon dioxide and water, as may be seen from the annexed equations, taken from Vaughan:



Complete Oxidation:



Hypoxanthin and guanine are sometimes considered in connection with uric acid and its derivatives, but as they are pathological products they belong more properly to putrefaction, where they will be discussed. The inorganic salts of the urine—sulphates, phosphates, etc.—have already been taken up in connection with the inorganic compounds of the body, so that there now remain only a few of the

SEROUS AND PATHOLOGICAL FLUIDS.

The latter belong more properly to pathology, but in conclusion it may be mentioned that *pericardial fluid* is yellowish, and contains about 5 per cent of solids. It is rich in fibrinogen and coagulates spontaneously if immediately removed from the body after death. If allowed to remain for some time it requires the addition of fibrino-plastin before this is accomplished. Cholesterin, uric acid, and urea are occasionally found in it.

Hydrocele fluid has a specific gravity of 1010 to 1025. It seldom clots spontaneously, but will coagulate after the addition of fibrino-plastin. Sugar, urea, and uric acid have been found in it.

Peritoneal fluid is normally very small in quantity, but pathologically it may be much increased, and varies greatly in appearance. Sometimes it is almost as clear and colorless as water, and again it is milky from finely divided fat. It may contain urea, uric acid, xanthin, creatin, cholesterin, lecithin, fat and albuminous substances, and its specific gravity varies from 1015 to 1020.

Pleural fluid may be either acid or alkaline in reaction, the former always being due to decomposition of pus; but those specimens which contain pus have a smaller specific gravity than those that do not. Specific gravity ranges from 1005 to 1030.

Cerebro-spinal fluid is a clear, strongly alkaline fluid of low specific gravity, 1002 to 1007, and consequently contains but a small amount of solids. The organic solids are cholesterin, urea, mucin, and a reducing substance not yet named: the inorganic are the chlorides, sulphates and phosphates of sodium and potassium.

The Aqueous humor of the eyes is a clear, feebly alkaline fluid which does not coagulate either spontaneously or when it is heated.

Synovial fluid has a faint yellow tint, is alkaline in reaction, and contains mucin, albumen, extractives, fat and inorganic salts.

The *Amniotic fluid* of the pregnant uterus is yellowish or brownish in color, and has a stale odor and a feebly alkaline reaction. It is generally turbid and deposits a whitish sediment, which under the microscope is shown to consist of epithelial scales. It contains serum, albumen, fibrino-plastin, urea, creatinin, and occasionally sugar and ammonium carbonate.

Chyle from the thoracic duct is a milky, yellowish, or pinky white fluid, with a slightly saline taste and characteristic odor. Its reaction is feebly alkaline and its specific gravity varies from 1012 to 1022. Its formed elements are the same as those of lymph, with the addition of much suspended fat whose granules are larger in chyle than in lymph, and are surrounded with albuminous envelopes. Shortly after its removal from the body, chyle coagulates with a pinkish white clot, which like the blood coagulum contracts and squeezes out its serum, which is opalescent from suspended fat.

Human milk is not unlike chyle in its composition, being a whitish fluid of sweetish taste and characteristic odor. Normal human milk always has an alkaline reaction, and its specific gravity varies from 1018 to 1045. Its opacity is due to suspended milk globules, which rise upon the milk being allowed to stand for several hours and form a layer of cream upon its surface, while the underlying fluid is thin and of a bluish tint. (See page 196.)

Spermatic fluid is of a grayish-white or yellowish-white tint, with a neutral or alkaline reaction and characteristic odor. Its formed elements are spermatozoa, corpuscles and epithelial cells; and its chemical constituents are a casein-like albumen, organic compounds containing phosphorus, and the same inorganic salts as are found in the blood. The fluid rapidly decomposes and throws down an abundant deposit of ammonio-magnesium phosphate crystals.

PUS AND EXUDATES.

An exudate is a fluid formed by arrest of the circulation of the blood from inflammation, and differs chemically from a transudate by the former containing albumen, blood globules, and having a greater specific gravity.

Pus is the most important of these exudates, being formed like the blood of a serum and numerous white corpuscles apparently identical with those of the blood. Pus, if healthy, is a dense yellowish-white liquid of a neutral reaction; exposed to the air it becomes acid and evolves ammonium sulphide and forms fatty acids.

Pus contains 15 to 16 per cent of soluble matter, the most important of which is albumen. The existence of a substance called *pyin* has been detected in it, but according to Lehman this body is an abnormal product. It generally contains a larger proportion of soluble salts than the serum of the blood.

Boedecker found in a pus slightly alkaline:

Water.....	88.76
Albumen.....	4.88
Pyin.....	4.65
Fatty bodies and cholesterin.....	1.09
Sodium chloride.....	0.59
Other alkaline salts.....	0.32
Earthy phosphates.....	0.21
	100.00

Certain varieties of pus have the property of imparting a blue tinge to linen. Fordos has discovered the principle which produces this coloration: it is a crystalline substance which he has named *pyocyanin*.

Pus swells, and assumes the appearance of gelatine on being mixed with ammonium hydrate. This reaction distinguishes it from mucus.

Pure pus, placed in a vessel and allowed to remain for several hours, separates into two layers. The lower, curdy layer contains the globules and the solids; the upper, opalescent layer constitutes the serum.

Pus serum, as has already been said, closely resembles blood serum, and occasionally contains other substances, among which may be mentioned, paraglobulin, tyrosin, leucin, xanthin, urea, glucose (in diabetes), bilirubin, uric and chlorrhodinic acids (in necrosis), and a special pus product, hydropsin.

II. THE PUTREFACTION OF THE BODY.

Putrefaction, according to Webster, is the process of becoming putrid or rotten. Chemically this is accomplished by the decomposition of molecules, that is, by the breaking up of more complex compounds into simpler ones by the action of the atmosphere and heat. This always takes place in an organized body as soon as life is extinct, for putrefaction follows death whether it be local or general. Huxley well defines these two forms of death as follows:

“ *Local death* is going on at every moment, and in most, if not in all, parts of the living body. Individual cells of the epidermis and of the epithelium are incessantly dying and being cast off, to be replaced by others which are, as constantly, coming into separate existence. The like is true of blood corpuscles, and probably of many other elements of the tissues.

“ This form of local death is insensible to ourselves, and is essential to the due maintenance of life. But, occasionally, local death occurs on a larger scale, as the result of injury, or as the consequence of disease. A burn, for example, may suddenly kill more or less of the skin; or part of the tissues of the skin may die, as in the case of the slough which lies in the midst of a boil; or a whole limb may die and exhibit the strange phenomena of *mortification*.

“ The local death of some tissues is followed by their regeneration. Not only all the forms of epidermis and epithelium, but nerve, connective tissue, bone, and, at any rate, some muscles, may be thus reproduced, even on a large scale. Cartilage once destroyed is not restored.

“ *General death* is of two kinds, *death of the body as a whole*, and *death of the tissues*. By the former term is implied the absolute cessation of the functions of the brain, of the circulatory, and of the respiratory organs; by the latter the entire disappearance of the vital actions of the ultimate structural constituents of the body. When death takes place, the body, as a whole, dies first, the death of the tissues sometimes not occurring until after a considerable interval.

“ Hence it is that, for some little time after what is ordinarily called death, the muscles of an executed criminal may be made to contract by the application of proper stimuli. The muscles are not dead, though the man is.”

Local death and its changes belongs to the physician and histologist, but the study of the changes following general death are the peculiar province of the embalmer. What, then, is putrefaction, and what are its causes?

Putrefaction is the name given to decomposition of organic matter attended with disagreeable odors, and is usually limited to that taking place in blood, flesh and other animal tissues, that is to say, in those substances whose rapid alteration begins with contact with the air but may finish without its participation. Organic decomposition is also called rotting, or slow combustion when substances such as wood or vegetable fibers gradually disintegrate with the indispensable assistance of the air. According to the ideas generally accepted at the present time, the phenomena of putrefaction are of three kinds, viz.: physical, chemical and vital, or those due to living organisms.

Physical embrace extravasation, rigor mortis and post-mortem hypos-

tasis, taking place eight to twelve hours after death in the dependent parts of bodies : hence to be looked for on the back of the head, neck, trunk, nails, back of arms, thighs, calves, if lying on back and vice versa. Inhibition of fluid under this head. Here also belong the mechanical action of gases evolved in the intestines.

Chemical changes are those which produce discoloration of body, viz.: a greenish, or yellowish purple discoloration of the skin of the abdomen and genitals and thence to other parts of the body, also other new chemical compounds such as gases produced about the body, distending the abdomen, hence purging and discoloration of the viscera often resembling poison, giving reddish brown, livid purple, green, or even black streaks.

Vital changes are those produced by bacteria and other low forms of life in the body after death. All of these phenomena well deserve the careful study of the educated embalmer: and to this end we shall discuss them in detail, borrowing largely for this purpose from "Tidy's Forensic Medicine," in which the subject is more exhaustively treated than any other book in the English language. Beginning with him at *rigor mortis*, or the first evidence of approaching decomposition in the body (See pages 97, 98), we are met with these practical questions arising out of the phenomena of post-mortem rigidity, to each of which we give Tidy's answers in full.

1. How soon after death does it appear?
2. In what order are the various parts of the body affected?
3. How soon does it pass off?
4. By what circumstances is it modified?

Old nurses and "layers out" are always extremely anxious to close the eyelids with a penny piece, and bind up the lower jaw the moment after death if they can, lest rigidity should intervene before they have time thus to compose the corpse. Our own observations have taught us that rigidity of the eyelids sometimes comes on in less than five minutes after death. Dr. Guy says "Even before the heart has ceased to beat in some cases," and Brown-Sequard confirms this. Sommer says he has known it to appear in ten minutes. From three to six hours is perhaps the average. Niderkorn, whose observations appear to have been made with great care, states that in more than two-thirds of his 135 cases, post-mortem rigidity was complete in the third, fourth, fifth, or sixth hour; in only two out of 116 cases was it complete as early as two hours. But he states that in all the 135 cases, some one or more of the articulations were rigid within the first two hours after death. There seems no well-authenticated case in which the supervention of post-mortem rigidity has been delayed beyond the day of death, although there are numerous cases in which it passes off so quickly as to be unnoticed.

Rigor mortis is generally believed to be due to the coagulation of the myosin in the muscle plasma (see page 97) in consequence of which the muscle becomes opaque, thicker, shorter, less elastic, and gives an acid reaction. After a longer or shorter time this rigor passes away never to return, and the coagulated albuminoid begins to decompose, its acid reaction changing to neutral or alkaline.

The order of its occurrence is nearly invariable. "Its stiffness always begins in the human subject with the trunk and neck, then attacks the thoracic limbs; and from them proceeds to the abdominal ones, so that the latter are still supple when the former are already stiff; and it follows the same order in disappearing, so that the legs are often quite stiff when the other parts of the body have regained their suppleness." Sommer (*De signis mortem hominis absolutem ante putredinis accessum indicantibus*, Copenhagen, 1833, a rare book, quoted by Orfila) says: "It begins in the neck and lower jaw, then attacks the upper extremities, lastly the pelvic limbs. It is rare for it to begin in the lower extremities, or to invade all four limbs at once. In two hundred cases Sommer found only one in which it did not begin in the neck." Larcher (in a memoir addressed to the Academy of Sciences, in the "Archives de Medicine," 1862) founded on the examination of six hundred bodies, states that "the order of post-mortem rigidity is always the same, no matter what the kind of death, whether sudden or slow, natural or accidental. The muscles of the lower jaw stiffen first, then the abdominal limbs, then the neck and muscles; lastly, more or less slowly, the thoracic limbs and arms. The muscles which are the first to stiffen, remain stiff the longest. It is also certain that the lower jaw and the knee stiffen more slowly and thoroughly than the shoulder."

Casper states that "it passes from above downwards, begins on the back of the neck and lower jaw, passes then into the facial muscles, the front of the neck, the chest the upper extremities, and last of all, the lower extremities. Usually it passes off in the same order, and once gone it never returns, and the body becomes as flexible as it formerly was."

Niderkorn says "the hip and knee go together, and the shoulder and elbow; in about half the cases the foot and wrist go with their larger joints. The *lower jaw* is usually first attacked, then the neck, then the lower extremities, but very often upper and lower extremities stiffen almost simultaneously."

In answer to the question, how soon does it pass off? it must be said that there are cases in which it passes off with extreme rapidity, even as soon as in one or two hours. In winter six or seven days are not uncommon. As long as three weeks have been noted in very cold weather.

The circumstances which modify rigor mortis are: (a) The age of the subject, and the condition of the muscular system. Excluding fetuses of immature growth, young subjects, etc., very old ones display the most complete rigidity. (b.) The mode of death. In very lingering diseases (such as phthisis) it often comes on very speedily, and disappears in an hour or two. In conditions of great exhaustion from fatigue (as at the end of a battle, or in hunted animals) the same thing occurs. In cholera it comes on early and lasts late. In most cases of violent death, and of poisoning, it sets in late and lasts long. Casper states that it is absent in narcotic poisoning. This is not, however, generally true. Habitual drunkards exhibit a long continuance of post-mortem rigidity. There can be no doubt that a low temperature of the surrounding air is favorable to the long persistence of this rigidity. On the other hand, Brown-Sequard and others have shown that it may come on in a warm bath, that it is exceedingly well marked in hot countries, and that it often comes on when the internal temperature of the corpse is above the normal. Paralyzed limbs become rigid, but the muscles of limbs shattered by accident do not stiffen like others. Post-mortem rigidity has been stated (on the high authority of John Hunter) not to occur in death by lightning. Mr. Gulliver and more lately Mr. B. Ward Richardson have shown this to be erroneous, both by cases and experiments. The latter points out that animals dying with an increase of their normal or natural temperature speedily become very strongly rigid, and remain stiff a long time. This often happens in small-pox, acute rheumatism, tetanus, meningitis, abdominal diseases, pyæmia, and the like. Lastly, cold water is favorable to the long continuance of post-mortem rigidity. (See page 98.)

When a joint or articulation stiff from rigor mortis, or post-mortem rigidity, is forcibly bent, the stiffness passes off, and does not return. This may distinguish death from certain cases of *supposed* trance, from cataleptic states, and from tetanic cases of rigidity or the effect of poisons. The progressive loss of heat in post-mortem rigidity, and the application of other tests for the reality of death will also save the careful medical man from mistaking stiffness in the living body for the rigidity which comes on after death.

A. B. Previous to the occurrence of post-mortem rigidity, the voluntary muscles have lost their irritability. In other words, chemical, mechanical, and other irritants, such as interrupted and induced currents of electricity, no longer excite contractions of the muscles. Whilst referring to treatises on physiology for details of the effects of various irritants on muscular fibers, the following facts appear to us of especial importance:

(1) Whilst healthy muscles are easily excited to contraction by

interrupted currents of moderate force (such as those from one of the ordinary "medical" machines in which the "keeper" is made to rotate between the poles of a magnet), yet this contractility even in life, may be in abeyance, or suspended, by the following agencies: (a) The effect of certain poisons, as in chronic lead-poisoning, strychnine and its congeners, nitrite of amyl, etc. (b) By previous exhaustion, from long-continued mechanical, electrical, and other stimuli. Hence it is undesirable in cases of suspended animation, to use galvanism or any form of electricity for prolonged periods of time. Even great fatigue, or repeated blows as in prize fights, or prolonged struggles, will have the same effect. (c) Long continued cold suspends, without destroying the irritability of voluntary muscles. According to Dr. B. Ward Richardson (Croonian Lectures, 1873) from 38 deg. to 28 deg. F. is the most favorable degree of cold for mere suspension. (d) Increased heat, especially about 12 deg. Fahrneheit (6.6 deg. Centigrade), above the normal temperature of an animal, if long-continued it tends to bring about a permanent loss of irritability, or *rigor mortis* in the muscles from coagulation of the myosin (Norris, Richardson, etc.) (e) A sudden sharp blow has been known to produce the same effect. (f) According to Nysten, the order in which muscular irritability *ceases* is the following: First in the left ventricle of the heart, then in the intestines and stomach, the urinary bladder, right ventricle of heart, oesophagus, iris, then in the voluntary muscles of the trunk, lower and upper extremities, lastly in the left and right auricle of the heart. (g) Certain diseases of the brain and spinal cord (Paralysis, especially Paraplegia, Pseudo-hypertrophic Paralysis of Duchenne, etc.) show suspension or entire loss of this irritability. (h) During a contraction of a muscle *heat* is produced, hence as a test it has been proposed to insert a delicate thermometer (registering at least tenths of a degree Centigrade) into the muscle to be tested, whilst an electric current is passed through it, or still better, through its nerves. (i) Sound is also produced when muscles contract forcibly. This susurrus might therefore be listened for with the stethoscope, whilst making the experiment to produce contraction. (To imitate this, listen over biceps whilst contracting, or insert tip of little finger into ear, and contract muscles of ball of thumbs quickly, Dr. Wallaston.) (j) After death, notably in yellow fever, cholera, and some other diseases, muscular movements, and muscular irritability in a marked degree, may persist for several hours after death, in other words, after respiration and circulation have ceased. (See Dr. Bennett Dowler's "Experimental Researches on Post-mortem Contractility," New York, 1846.) (k) It is a disputed point whether the blood has any appreciable influence upon muscular irritability after death. It is, however, known that ligation of a large artery in animals suspends or greatly

diminishes this irritability, as do large losses of blood, whilst artificial circulation, especially of warm fluids, restores it. (7) Lastly, certain curious so-called psychical states, such as trance, hysteria, shock, etc., suspend or greatly impair muscular contractility.

Tidy well remarks that even putrefaction *per se* is not conclusive proof of general death, for the reason that it may only prove local death as in the case of gangrene of the limbs, face, or trunk, etc., after severe local injuries, or in certain feeble states of health. (2) The spontaneous changes of color undergone by extravasated blood, or what is popularly known as a "bruise," simulate the coloration due to putrefaction. It is pretty obvious, too, that such an appearance might be artificially produced by pigments. (3) The odor of decomposition, so far from being exclusively a post-mortem phenomenon, is met with in certain diseases, as gangrene of the lungs, etc., ulcers of the lower extremities, caries of bones (ozena), and the like. It must, however, be admitted that general and advanced decomposition of the tissues is one of the safest signs of death. The phenomena presented by dead bodies undergoing putrefaction may be classed as follows.

Phenomena of Putrefaction.

- (a) Appearances due to extravasation and imbibition of fluids.
- { (b) Those due to putrefaction itself, and the evolution of gases.
- { (c) Those due to saponification, or the formation of the *adipocere*.
- { (d) Those due to mummification, or slow drying of the tissues.

A. Appearances due to extravasation of and imbibition of fluids.

(a) Post-mortem stains or hypostases. Very soon after death (eight to twelve hours, Casper) the dependent or lowest parts of the body (no matter what the position) acquire an appearance which closely simulates the effects of bruises or contusions. The blood (See page 186) *within* the body after death coagulates just as blood withdrawn from the living body does, though more slowly. In acute inflammations, where the amount of fibrin is much increased, this coagulation sometimes precedes the actual moment of death, and is in fact one of the modes of death. In diseases such as those fevers which diminish the quantity of fibrin or reduce it to almost nothing, as *e.g.*, phthisis, the blood may scarcely coagulate at all. Sir James Paget has drawn attention to the subject of "Coagulation of the Blood after Death," in a paper with this title in the *London Medical Gazette*, vol. xxvii., page 613 etc. He shows that the position of the red blood corpuscles, in other words, of the most deeply-colored portion of the clot, may often determine the position of the body after death. It is generally said that the seat of the discolorations after death (cadaveric lividity) differs from that of the discoloration produced when the man was alive; the rete muscous and vascular mem-

brane exterior to (above) the true skin, being the parts affected by post-mortem changes, the true skin being found injected and ecchymosed in bruises inflicted during life, and from the effects of poisons and struggles. Dr. Guy has shown that this is by no means always true ("Manual," page 238). No blood flows from an incision into post-mortem stains, or at most only a few bloody points can be made out in most cases. In cases of dropsy, however, a blood-stained serum might exude. These post-mortem stains or hypostasis are divided into internal and external. The latter are to be looked for at the back of the head, neck and trunk, the nates, back of arms and thighs, calves, etc., in ordinary cases; but they may also be found on the face, ears and sides, and as before stated, on the lowest or most dependent parts of the body, whatever its position may have been. If the body be turned over whilst still warm, the original stains more or less disappear, and fresh ones may form. The color varies from livid or coppery-red to reddish-blue, and the outlines are very irregular, as is the size of the spots or stains. Some medical jurists call these post-mortem stains *suggillation*, an ambiguous term. Those resembling stripes are called *vibices*. It is important for you to know that such marks closely simulating the effects of flogging may be produced by the pressure of clothes, or of the surface on which the body is lying. Occasionally post-mortem ecchymoses, particularly in death by lightning, assume an arborescent or tree-like form, which appears to be due to the distension of cutaneous capillaries and small veins. The larger marks do not always correspond to the cutaneous veins, etc., described in books, but it must be remembered that great irregularities are met with in the cutaneous veins.

Internal hypostases, or blood-stains, occur chiefly in the following situations: (1) In the veins of the pia mater of the posterior hemisphere, in the ordinary position of the head after death. (2) In the posterior part of the lungs. This appears to be true of *all* bodies, especially in cases of old or feeble persons. About one-fourth of the lungs is thus marked. (3) On the intestines. This may be mistaken by the incautious for peritonitis. To guard yourselves from this, pull the convolutions of the bowels forward, and you will see "breaks" in the redness. On the posterior or dependent portions of the *interior* of the stomach, and small intestines a similar discoloration may be met with, due simply to small hypostatic injections. (4) In the posterior parts of the kidneys. (5) In the spinal cord, posteriorly, particularly in its pia mater. You should familiarize yourselves with the appearances presented in the post-mortem room, both on the exterior and interior of the body. They will be your best safeguard against those ridiculous mistakes which are constantly made by persons ignorant of these matters. Were they only ridiculous, but little harm would be done; but, unfor-

tunately, there is a serious side, and innocent persons may be condemned by mistakes originating in ignorance.

It is quite clear that besides coagulation of the blood, there is also a solution of its coloring matter in many cases, probably due to ammoniacal gas; and that the subsequent changes of color are due to varying degrees of oxidation, and to the separation of iron from the coloring matter. Similar changes occur in old apoplectic clots.

Bile-stains. Soon after death, changes take place in bile, so that its coloring matter oozes through the gall-bladder, and other parts which contain it. In this way the contiguous parts of the stomach and intestines may be stained of a yellowish or greenish color. Do not mistake this for the effect of corrosive poisons.

Changes produced by Putrefaction and the Evolution of gases. These become evident to sight, smell, and chemical tests. One of the earliest signs of putrefaction is a greenish or greenish-purple, or yellowish-green discoloration of the skin of the abdomen. This next extends itself to the genitals, and then to other parts of the body. The discoloration of the eye has already been noticed (Pages 93-94). Next, gases of various kinds are generated in more or less abundance, giving the body a bloated appearance, and especially distending the abdomen. In some cases the gas is highly inflammable. The chief gases which have been recognized by chemists as evolved from decomposing bodies are:

1. CARBONIC ACID GAS.

Synonyms: Carbonic Anhydride, Carbonic Oxide, Mephitic Air, Choke Damp, etc. *Formula:* CO_2 .

Origin: It is one of the final products of the retrograde metamorphosis of all organized bodies, and is formed constantly during life and similarly after death from the tissues.

Properties: A colorless, poisonous gas, whose properties are described on page 138.

Tests: Known by reactions with lime or baryta-water and reddening litmus paper transiently. Carbonic acid gas is the compound into which the carbon of organic compounds is transformed in quantitative analysis.

2. CARBON MONOXIDE.

Formula, CO . *Molecular weight,* 28. *Specific gravity,* 0.9673. *One hundred cubic inches weigh 30.21 grains.*

Properties: Carbon monoxide is a colorless, inodorous, tasteless and very poisonous gas, which burns readily with a blue flame, producing carbonic anhydride. It is easily produced from carbon by various processes, and always occurs when charcoal is burned in a furnace in which the supply of oxygen from the air is not sufficient for the amount

of charcoal under combustion. This gas is poisonous. (See Poisons.) When present in considerable quantities it is exceedingly fatal to life, one per cent of this gas in the air being sufficient to kill small mammals. The combination of this gas with the globules of the blood renders them incapable of carrying oxygen, and this causes death. The chemical union thus made is quite stable, and recovery from the effects of inhaling carbon monoxide, slow and difficult.

Carbonous oxide unites readily with oxygen to form carbonic anhydride, as above stated. It also combines with chlorine to form carbonyl-chloride or $(CO)Cl_2$. It has been liquified by Cailletet; is but slightly soluble in water, and has no effect upon litmus paper.

Test: Burns with a pale blue flame, unlike the other oxide of carbon (CO_2), which is not combustible.

3. AMMONIA GAS.

Synonym: Hydrogen nitride. *Formula,* NH_3 . *Molecular weight,* 17. *Specific gravity,* 0.589.

Origin: Ammonia gas is artificially prepared by mixing together powdered sal-ammoniac and slaked lime and applying a gentle heat. It is found chemically combined with acids in the urine of men and the lower animals. It is produced when nitrogenous substances are exposed to the air or are oxidized by air or water. It is one of the constant products of decomposition of the nitrogenous principles of the animal or vegetable kingdoms, and ordinarily accompanies carbonic acid, acetic acid, etc., which are given off at the same time.

Properties: It is a colorless, sharp, caustic gas, with a strong, pungent odor, irritating to the eyes and air passages and causing a flow of tears; it extinguishes lighted candles, but can be made to burn in an atmosphere of oxygen. It is extremely soluble in water, one volume of water dissolving 700 volumes of this gas, and forming the well-known *aqua ammoniæ*.

Chemism: Ammonia possesses in an eminent degree the qualities called *alkaline*. It turns litmus paper blue and turmeric brown, and combines readily with acids, neutralizing them completely. Under a pressure of six atmospheres at 10° it condenses to a colorless liquid. Being still further subjected to cold, the liquid freezes to a solid, transparent, crystalline mass. Ammonia was once considered by many chemists the vehicle of miasm and putrefaction, by even as good a one as Vauquelin, who, from his analyses of tobacco, came to the conclusion that many bodies were rendered odorous by their combination with ammonia, or as Parent Du Chalet in 1835 expressed it, "ammonia gives wings to fetid matter."

Tests: Its pungent odor, alkaline reaction (blue) with red litmus

paper and white fumes with hydrochloric acid. Ammonia gas is the usual method adopted for setting free and estimating the nitrogen in organic matter, for when this is heated with caustic soda or potash the whole of its nitrogen is given up in the form of ammonia gas.

4. HYDROGEN SULPHIDE.

Synonyms: Sulphuretted hydrogen, hydro-sulphuric and sulphurhydric acid, hepatic gas (Halle).

History: The precise nature of the gas, described by Halle under the name of hepatic gas, and by him supposed to be the sole cause of the asphyxia and disgusting odors produced by a dead body, was not understood until this gas was isolated by Thenard, and studied by him, Dupeyren, Barreul and others.

Properties: Are given on page 139.

Origin: Produced by the decomposition of the albuminoids, bile, and other substances which contain the sulphur of the body.

Tests: Its fetid odor resembling rotten eggs, and its power of turning paper soaked in a solution of acetate lead black when placed near it. If sulphuretted hydrogen and ammonia gas are combined, a paper moistened with nitro-prusside of sodium, when exposed to the mixed gases, acquires a crimson tint.

5. CARBURETTED HYDROGEN.

Synonyms: Marsh gas, methane, mythlic hydride, sub-carburetted hydrogen, heavy inflammable air, fire-damp, pit gas.

For properties of this colorless, odorless gas, see page 139.

Tests: Burns like ordinary illuminating gas, producing water and CO by its combustion.

6. NITROGEN,

or azote, as it was formerly called, is described on page 111. Guyton DeMorveau thought that condensed azote was the principal part of all contagious virus, but fuller study has proven it the most inert and negative of all the gases.

Tests: Depend upon its failures to respond to the reactions for the other gases, for this is colorless, odorless, tasteless, and non-inflammable.

7. PHOSPHORETTED HYDROGEN.

Synonyms: Gaseous hydrogen phosphide, phosphonia, phosphonine, phosphorous trihydride, phosphine. *Formula*, PH_3 . *Molecular weight*, 34. *Specific gravity*, 1.19.

Phosphoretted hydrogen is formed during the decomposition of organic substances containing phosphorus. The natural phenomenon of the "Will o' the Wisp" is an example of the formation of this gas.

Properties: A colorless gas, with a strong, garlic-like odor, slightly soluble in water, and burning with a brilliant white flame, forming phosphoric acid and water.

The pure gas fires on being raised to a temperature of about 70° , and as ordinarily prepared (from heating phosphorous with potassium hydrate) the gas is spontaneously inflammable, and as the bubbles enter the air they take fire, forming white rings of P_2O_5 , thus producing the phosphorescence sometimes seen about a corpse.

Phosphine is slightly acid in its action upon blue litmus-paper. In passing through metallic solutions it is decomposed, and metallic phosphides are precipitated. When mixed with oxygen it explodes.

OXYGEN (page 111) and HYDROGEN (page 110) have been fully described previously and need no further mention here. These gases may be generated, either from the tissues, or from the food and feces in the stomach and intestines, and may tinge both the exterior and interior of the viscera in a remarkable manner, often resembling the effects of poison. Reddish-brown, deep-livid purples, slate color, and green or greenish-yellow, or even black streaks or lines, may be found. The color of the blood in the veins or heart may also be greatly changed by these spontaneous decompositions.

The force of the gas generated has been sufficient, in some cases, to empty the heart and great vessels—even, it is said, to expel the fetus from the uterus and to burst the coffins, even when made of lead, in which such bodies have been inclosed. There is a popular idea prevalent, that it is *common* for bodies to burst; but this is the reverse of truth.

The evolution of gases within the body forces up the diaphragm by the distension of the bowels, and the same pressure crowds the blood toward the head and neck: the face swells, and the eyes, which previously had been sunken, now protrude and may even rupture. Mucus, bloody froth and the contents of the stomach and lungs are forced out, and at times the contents of the bowels are similarly discharged. Blood and sanguineous fluids issue from wounds or ruptured vessels, and all the loose tissues, as the eyelids, scrotum, penis and labia, are distended by gas produced by the decomposition of the tissues. Bullæ, or vesications, form, and the hair, nails, and scarf-skin easily become detached. *The breath and portions of the body have been luminous in the dark in some cases*, generally in advanced stages of consumption, or wasting disease. (See Phosphoretted hydrogen.)

Although the occurrence of putrefaction is very variable as to time, the general order for the time and succession of its various steps can scarcely be better given than in Dr. Letheby's words:

“In about eight or ten hours after death, the surface of the body,

especially over the chest and on the inside of the arms and thighs, puts on a marbled appearance, due to a turgescence of the superficial veins. In about sixteen hours the dependent parts become livid or reddish-purple, and after the lapse of twenty-four hours, this lividity is generally very marked, and the marbling on the chest and arms begins to acquire a purplish tint. About the second day it assumes a brownish hue, and by this time the abdomen and groins show more evident marks of the putrefactive process by acquiring a green color. From this period it advances with more or less rapidity, according to attendant circumstances. In five or six days the entire surface is ordinarily very green, and the venous marbling more strongly marked. About this time, in warm weather, the epidermis begins to loosen, and the fluids acquire great liquidity, and gravitate to the dependent parts, through which they readily escape. Beyond this, the track of decomposition can scarcely be followed with any certainty."

"*In what order does putrefaction advance in internal organs?*" In other words, What parts of the body putrefy first, and which resist longest? As an aid to the memory, it may be said that the *windpipe and brain* are first attacked, and the *heart, lungs and uterus* last. Casper gives the following order:

1. Larynx and trachea (3 to 5 days).
2. Brain of infants and small children.
3. Stomach (4 to 6 days).
4. Intestines.
5. Spleen (often earlier).
6. Liver—gall bladder, later.
7. Brain of adults.
8. Lungs and heart.
9. Kidneys.
10. Urinary bladder.
11. Oesophagus.
12. Pancreas.
13. Diaphragm.
14. Large vessels.
15. Uterus—as late as nine months (Casper).

This is the usual order of putrefaction; but, as has been mentioned elsewhere (Natural Mummies, pp. 30–32), the natural course of putrefaction may be arrested by cold or other causes. One of these causes is the change of the body into

ADIPOCERE.

Under certain circumstances, particularly in bodies long immersed in water; in very fat bodies, particularly of young persons, and in bodies

buried one on top of another, at a considerable depth, in a moist soil, a curious soapy, unctuous substance, named adipocere, from *adeps*, lard, and *cera*, wax, is formed principally out of the fatty tissues. Although it is said to have been known to the ancients, and mentioned by Lord Bacon, this substance attracted little attention till the publication of Fourcroy's Memoir, read in 1789 to the Royal Academy of Sciences of Paris. He found in the removal of many bodies from the Cemetiere des Innocens, in Paris, that the bodies presented three different states : 1. The most ancient were simply portions of bones irregularly dispersed in the soil, which had been frequently disturbed. 2. A second state exhibited the skin, muscles, tendons and aponeuroses, in bodies which had been insulated, dry, brittle, hard, more or less gray, and like what are called natural "mummies" (See p. 31). 3. The most singular state was observed in the common graves, where large numbers had been interred in deep pits, one above the other. On opening one of these, which had been quite closed for fifteen years, he found the coffins fairly preserved ; the lining which had covered them was slightly adherent to the flattened bodies, and with the form of the different regions exhibited. On opening was found nothing but irregular masses of a soft ductile matter, of a gray-white color, resembling common white cheese. "It was sometimes found nearly white, at others yellowish-brown ; sometimes brittle and dry, always more or less unctuous or soapy." Since the publication of this memoir, many researches have been made into the formation of this singular substance, which is by no means invariably of the same composition. Thus, some samples melt at less than 200° Fahrenheit ; some, examined by Dr. Taylor, required a higher temperature. Most specimens appear to be an ammoniacal soap, and are soluble in hot alcohol, making a lather with water, whilst others contain lime as a base. Whether lime or ammonia, the base is combined with oleic, stearic, and perhaps palmitic acid. As all the tissues contain more or less fat, almost every part of the body may be gradually converted into adipocere—even the bones to a great extent—but the skin, breasts, and fat of various organs are first so converted ; more slowly muscles, solid viscera, and the harder tissues.

It appears certain that under certain favorable circumstances, as in running water, a body can be partially converted into adipocere in from four to five or six weeks. (See Devergie, loc. cit.; also Dr. Giles "Experiments on Meat.") Dr. Taylor states that a female interred in a common grave, after fourteen months was partially converted into this substance, chiefly the lower part of her body. The *period* required by this change is therefore much less than was stated by the grave-diggers to Fourcroy. This has already been the subject of inquiry at a trial. An insolvent gentleman, named Meecham, left his house November 3,

as was supposed from his words and manner, to destroy himself. Five weeks and four days after (December 12) his body was found floating down a river, three miles from his home. Besides appearances of putrefaction in the face and scalp, the lower part of the abdomen and the gluteal muscles were found converted into adipocere. A commission of bankruptcy was taken out against him in a few days after he left home. The medico-legal question was, "Is it probable he drowned himself on the day he left home?" In which case the bankruptcy would be annulled. Dr. Gibbes, of Bath, gave evidence that adipocere required at least a month, perhaps five or six weeks, to be found in any quantity, even in running water. The jury decided on this, that he had drowned himself when the commission was taken out.

ORDER IN WHICH THE SIGNS OF DEATH SUCCEED EACH OTHER.

The rapidity of decomposition in some cases, and the length of time during which it is retarded in others, renders it very unsafe to give any general rule which shall settle the time a body has been dead. An opinion must be founded upon the condition of all the organs, the mode of death, and the surroundings—including in the latter term the season of the year, the amount of heat and moisture, and the quantity of clothing, depth of grave, etc. But Casper's rules will be found correct in the majority of cases. With slight alteration these are as follows:

(1.) *Signs of death present in bodies dead from ten to twelve hours at longest.*

1. Complete cessation of respiration and circulation—no evidence of either, even by auscultation.

2. The eye has lost its luster, the pupil is immovable, and the globe has lost its normal tension.

3. No stimulus has any power of producing reaction.

(In previously healthy subjects who have met with a violent or sudden death, galvanism—interrupted currents and shocks from any electric machine—may, however, produce movements, as in Galvani's well-known experiments for some hours after death.)

4. The body is ashy white. (Except in jaundice, or yellow colorations from poisons, and in persons with very florid complexions. Tattoomarks, the edges of ulcers, bruises, and wounds inflicted during life, and extravasations, as in purpura, must be excepted also.)

5. Most bodies are quite cold from eight to twelve hours (See pages 95,97).

6. There is a state of general relaxation and flaccidity (unless rigor mortis be present, and sometimes even then), with flattening of the nates, calves, etc., when subjected to the pressure of their own weights, and this is strikingly shown in the globe of the eye.

7. Dependent or posterior portions of the body begin to exhibit a bruised-like condition, known as post-mortem staining, or hypostasis—internal and external.

II. *Signs of death present in bodies from two to three days.* In addition to all, or nearly all the preceding, especially the post-mortem stains we get

8. Coagulation of the blood (See hereafter), and

9. Rigor mortis is either present, or has passed off. (See pages 97–98.)

As regards *frozen* bodies, the rigidity due to frost is known by its affecting all parts of the body and completely fixing the articulations.

III. *Signs of death in bodies dead more than three days.*

10. Except in very rare cases, there will now be signs of *putrefaction*. The exceptions will be in very cold weather, or bodies preserved in ice, or some modes of death (as alcohol poisoning), or when some method of hindering decomposition, has been employed; or at later periods, when mummification or saponification (formation of adipocere), of which we have just spoken, has modified this process.

11. The temperature will now be that of the surrounding medium, or but little above it.

12. And the muscles will no longer respond to the strongest galvanic current or electric shock.

CAUTIONS AS TO PUTREFACTION.

It is generally admitted that the earlier stages of this process are the most dangerous as regards infection from what are commonly called “post-mortem or dissection wounds.” Some of the later stages may, however, be equally dangerous, or even more so, unless precautions are taken to insure the dilution of the poisonous gases with a large bulk of air, and disinfection by chemical means. The matters, are, however, not so much within the province of our studies as are the following:

1. Casper states, very properly, that bodies green from putridity, blown up with gases and excoriated, at the expiration of one month, or from three to five months after death (this stage of putrefaction lasting a long time in some cases), coet. par. cannot with any certainty be distinguished from each other, as regards either recognizing the features, or stating which died first, or how long death has taken place.

2. We should hardly ever refuse to perform a post-mortem examination merely on account of putridity, since in the most rotten corpses we can generally determine the sex and age (from the bones or hair, or discovery of a uterus), and very often the mode of death, as for example, in apoplexy, aneurism, and many forms of poisoning, notably arsenical, strychnine, and sometimes the existence of pregnancy, from finding fetal bones, etc., in the interior of a woman's body, or some article, as a false tooth, or ring, or truss, or the loss of a limb, or an united or other

fracture which may lead to identification, as an united fracture did in the case of Dr. Livingstone.

B.—THE CAUSES WHICH HASTEN OR RETARD PUTREFACTION.

“Dust to dust” is nature’s fiat, and she accomplishes her will by means of five agents, or what might appropriately be called natural disinfectants. These are :

1. Water or moisture.
2. Oxygen or air.
3. Soil or earth.
4. Heat or fire.
5. Bacteria.

For, by the aid of these, in due time after death a body will return to its primitive elements, with the exception of its hair, teeth and bones, which may under favorable circumstances be preserved almost indefinitely. There is said to be in the British museum a wig, found at Thebes, that cannot be less than 3400 years old. Shakespeare says a “tanner will last you nine years,” and his statement is within the truth for there are preserved in the College of Surgeons, London, portions of dried human integument, taken from beneath the heads of nails driven into the doors of Worcester Cathedral, more than 1000 years old. The microscope proves that this skin belonged to a fair haired person, probably a Dane, for history tells us that they were in the habit of crossing over to England to pillage cathedrals, and when caught in the act were flayed alive and their skins nailed to the doors of the church they had attacked. These, however, are exceptional cases for with the loss of vitality, the presence of moisture and oxygen, and a temperature above 32° F. and below 182°—more exactly between 40° and 200° F.—the integument and other tissues rapidly decompose. Consequently the onset and rapidity of putrefaction depend upon the presence or absence of these factors. If they are completely held in abeyance by chemical or other means the body may be kept for hundreds of years. King Edward I., of England, buried in 1307, was found entire in 1770 (463 years) : Canute died in 1036 and his body was found very fresh in 1776 (740 years), and the bodies of William the Conqueror, and his Queen Matilda, were found entire at Caen in the sixteenth century. King Charles the First’s head was found 165 years after decapitation wrapped in a cere cloth and some unctuous matter which had preserved it from decomposition. Still more remarkable is the discovery, during the present year, of the mummy of the Pharaoh, whose daughter adopted Moses, and whose face still shows him, although nearly a hundred years old at the time of his death, a vigorous and robust old man, with pride and kingly authority

still imprinted there. This preservation, as has been said elsewhere, would have been impossible except in as dry a climate as Egypt, for one of the most potent aids to decomposition is

MOISTURE.

Water itself does not putrefy, but is essential to putrefaction; for, as we shall see later, it is essential to the growth of bacteria, and furthermore a perfectly dried body does not undergo decomposition. Hence it is that pemmican and well “jerked beef” can be kept for long times. Similar reasons undoubtedly account for the preservation of human bodies in the Arabian desert and in the vaults at Strasburg (See page 30) and Charlottenburg, Prussia, where a low temperature and a drying wind have produced gradual and complete desiccation. Spare, thin bodies, with little fat or fluids, are most readily preserved in this way, but almost any organized compound may be thus kept, if first thoroughly dried and then completely protected from moisture. Dried eggs keep perfectly so long as they are kept from moisture. The cause of this difference ought not to be sought alone in its difference in the amount of moisture, for coagulated white of an egg contains as much water as when it is liquid, but these changes are brought about, probably, by the fact that ferments themselves are albuminous, and similarly affected by the heat necessary for drying thoroughly egg albumen.

The chief part that water plays in putrefaction is to facilitate the secretion and propagation of bacteria. (See later.) When a vegetable or an animal dies we may say with Becher that it gives up its life for the good of a multitude of vegetables and animals of an inferior order, and vegetable and animal life cannot exist without water. Laying aside for the moment all theories of the genesis of ferments and bacteria, we may say, without moisture no germs nor decomposition, so that the oldest of all means of preservation is that of desiccation. From all times grain has been dried because that moisture and heat causes it to germinate. Wet wood decomposes very rapidly; dry wood is more permanent; but even that contains from ten to fifteen per cent of water, and if this is driven off by a complete desiccation it becomes protected from all future alteration. The abundance of water, nearly sixty per cent, in the body and its fluids, immediately and actively influences its dissolution, as may be readily seen by comparing Casper's table of the order of decomposition with the relative amount of water contained in each tissue, *e. g.*:

Tissues.	Percentage of water.
Mucous membrane.....	90
Brain and nerves.....	78
Spleen.....	75
Liver.....	69
Lungs and heart	75

when it will be found that the larger the percentage of water, the more rapid putrefaction, provided the organs are similarly exposed to the second factor in organic decomposition, viz.:

OXYGEN OR THE AIR.

An organic body entirely prevented from contact with the air can be preserved, as the same result takes place when it is removed from the action of moisture or heat. All of which facts were apparently well known to the Egyptians, and utilized by them in the preparation of their mummies (See pp. 35-36), and also by the Ethiopians if we can believe Herodotus' tales in reference to the preservation of their dead (See Glass). Under ordinary circumstances exposure of a body to light, air and moisture, accomplishes the dissolution of its soft parts entirely in from two to three years, and in so far as air is excluded is the process delayed. This was strikingly shown in the bodies of the Etruscan kings found some years ago in their rock sepulchers where they had been preserved, protected from the atmosphere unchanged for hundreds of years, but no sooner was the air admitted than these bodies began to crumble, and in a few hours were converted into unrecognizable dust.

Nearly a hundred years since, Benjamin Appert demonstrated that meat sealed up in air-tight boxes, after being heated, so as to expel the air, would keep for an indefinite length of time at ordinary temperatures. On this depends the modern extensive use of canned meats, for it is well known that, after having been heated and sealed up in air-tight cans, and thus protected from the atmosphere, meats will remain sweet and fresh as long as the receptacle remains air-tight. We also know that fruits heated and sealed keep fresh and free from the fermentative process for a long time; in fact there are said to be in the museum at Naples canned fruits, still edible, although sealed up in Pompeii more than 1,800 years ago.

Air is not an element, as was once thought, but a mixture of oxygen, nitrogen and carbon dioxide (See pp. 136-138) in the proportion of 21 parts of the former to 79 of all other gases combined. This one-fifth part of oxygen is what is generally believed to be the chief agent in the breaking down of the body after death. Its union with the tissues, or their oxidation, produces many new compounds as we shall see hereafter, both innocuous and otherwise. Many causes influence the rapidity of this oxidation, not the least of which is the condition of the body at the time of death, for when it results from septic diseases putrefaction begins almost immediately after the body grows cold; its effects are noticeable much sooner when the atmosphere is warm. In general, in our climate, the work of decomposition becomes evident after from thirty-five to forty hours. Its first effects are

noticeable on the skin of the stomach : this takes on a greenish discoloration, which soon spreads and covers the whole surface of the body ; at the same time everything is seized upon by what is termed putridity ; the moist parts soften and decay ; little by little the flesh sinks and grows watery, and is thus carried away or burned up by the air's oxygen, for chemically the final results are the same whether a body be allowed slowly to rot for a term of years or is rapidly burned in a few minutes.

But it must be remembered that the oxygen of the air is not the sole cause of putrefaction for it has been over and over again proven that while air is apparently essential to begin decomposition, it is not essential to its continuance after it has once begun (See Oxygen in section on Antiseptics), and hence the failure of hermetically sealed coffins to prevent decomposition. The explanation of this is found in the fact that putrefaction largely depends upon microscopic germs or ova constantly floating in the atmosphere (See Bacteria), whose growth and multiplication takes place whenever they are deposited by the air in an appropriate soil or fluid, among the best of which are the albuminous fluids of the body. The numbers and rapidity of multiplication of these bacteria is almost incredible, for Cohn has shown that bacterial multiplication can arise in the course of about an hour. At this rate a single bacterium would produce two in one hour, these by doubling would increase to four in the second hour, and so on until in the lapse of three days the scarcely conceivable figure of 4,772,000,000,000 would be attained weighing in the aggregate 7,500 tons. In reality this scarcely conceivable rate of reproduction is not maintained long for want of nourishment. Yet a growth not far behind these marvelous figures can be observed when bacteria invade a favorable soil, such as a cooked potato. The merest speck with which the soil is infected will grow at the proper temperature at such a rate that within a day the whole potato becomes fairly alive.

The part that bacteria play in putrefaction will be fully discussed under the appropriate head for which it is reserved. For the present we wish simply to allude to the presence of their ova in the air, and before speaking of bacteria take up the consideration of some of the other agents which influence the decomposition of the body.

THE NATURE OF THE SOIL

in which the body is deposited has much to do with the rapidity, or otherwise, of putrefaction. *Damp and water-logged soils*, clay and heavy loam, are most unfavorable to rapid decomposition, for in these cases, excess of moisture and partial supply of air indefinitely prolong the process. Bodies of men, horses and other animals have been preserved for centuries in the bogs of Ireland and Scotland.

Clayey soils often have remarkable preservative powers, as proven

for instance, by the body of Gen. Wayne, which was perfectly kept for forty years in an argillaceous soil. Still more remarkable are the clay pits of Maine, where the bodies are preserved as far as embedded, while the exposed parts decay as usual.

The soil that is most fitting for burial is a fine *carboniferous mold*, or a mixture of carbon, lime and sand. In such a soil the complete removal of the body, bones and all may, under proper conditions, be secured within a period of ten years.

A fresh, carboniferous earth answers exceedingly well, far better than simple carbon, for it both disinfects with surprising rapidity, and equally rapidly destroys organic substances, if kept dry, twenty to thirty weeks being sufficient. In Naples it is the custom to bury in pits of earth with which *lime* has been mixed, and to bury so many bodies in one section on a given day, then to allow that section to remain unopened for a year, at the expiration of which time the whole of the earth is removed and a new mixture of earth and lime prepared for fresh burials.

In open, *porous, sandy or gravelly* soils, on the other hand, in which drainage is perfect and the soil is always largely charged with air, the disinfection of buried carcasses or other infecting products takes place with great readiness. In such soils, as a rule, three years will complete decay, but in the tenacious and clayey lands ten to twelve often do not suffice. The British Home Office (Board of Health) wisely have ordered that "no unwall'd grave shall be opened within fourteen years after the burial of a person above twelve years or within eight years after the burial of a child under twelve years, etc. * * * and if on reopening any grave the soil be found to be offensive, such soil shall not be disturbed and in no case shall human remains be removed from the grave." Not less important than soil are the effects on putrefaction of

HEAT AND COLD.

Sufficient absence of heat, or cold, as we usually call it, absolutely prevents putrefaction, for a body that is frozen cannot putrefy. A remarkable instance of this is given by Tidy, who states that the body of Prince Menchikoff, a favorite of Peter the Great, exhumed, after ninety-two years burial in frozen soil, at Beresov (in Siberia) had undergone hardly any change. "The Quarterly Journal of Science," vol. viii., page 95, gives an account of the discovery, in a remarkable state of preservation, of the body of an extinct species of elephant (*E. primigenius*) in a mass of ice in Siberia in the year 1805. After being dug from the ice the flesh was greedily eaten by the Laplanders, although geologists concur in their statement that the animal had been thus entombed for several thousand years. The skeleton of this animal is preserved in a museum at St. Petersburg, together with what of its skin had escaped

destruction by the dogs of the Laplanders. Freezing in its effects on putrefaction is very like perfect dryness, for a certain degree of heat seems to be necessary for the multiplication of the lower forms of life; but the range is between 40 and 300° F., for the latter kills all bacteria.

Excessive heat produces an effect very like the privation of heat, not that intense heat which destroys organic matter, but such as is necessary to bring a body to the temperature of boiling water, holds decomposition in check. If the same high temperature could be maintained the preservation of a substance would be assured so long as it is kept from moistness, but as soon as it is again subjected to the temperature of the ordinary air, ferments attack it and begin their alterations. We may then for the present, omitting the influence of bacteria, sum up the *causes which retard putrefaction as*:

(a) Temperature of 32° F. (0° C.) and below this (cold weather and cold rooms.)

(b) Temperature above 212° F. (100° C.) Hemorrhages, if very profuse.

(c) Complete or nearly complete immersion in water retards decomposition (See Drowning), or a very deep grave.

(d) The body being protected by clothing, or other coverings.

(e) Burial, especially in dry sand or earth, and burial very soon after death.

(f) Dry, elevated ground, as a place of burial.

(g) Some poisons, as arsenic, alcohol, chloroform, strychnine, phosphorous, (Casper.)

(h) Certain gases. Nitrogen, the residuum of air inclosed in air-tight coffins.

(i) Leanness.

(j) Old age, unless corpulence, or other special reason, as dropsy.

Per contra. We should bear in mind the

Causes which favor putrefaction, viz.:

(a) Temperature between 70° and 100° F. (21.1° and 37.7° C.) therefore summer weather and warm rooms.

(b) Moisture—therefore brain and eyes soon putrefy, so do dropsical subjects.

(c) Low swampy ground, as a place of burial.

(d) Free access of air.

(e) A shallow grave.

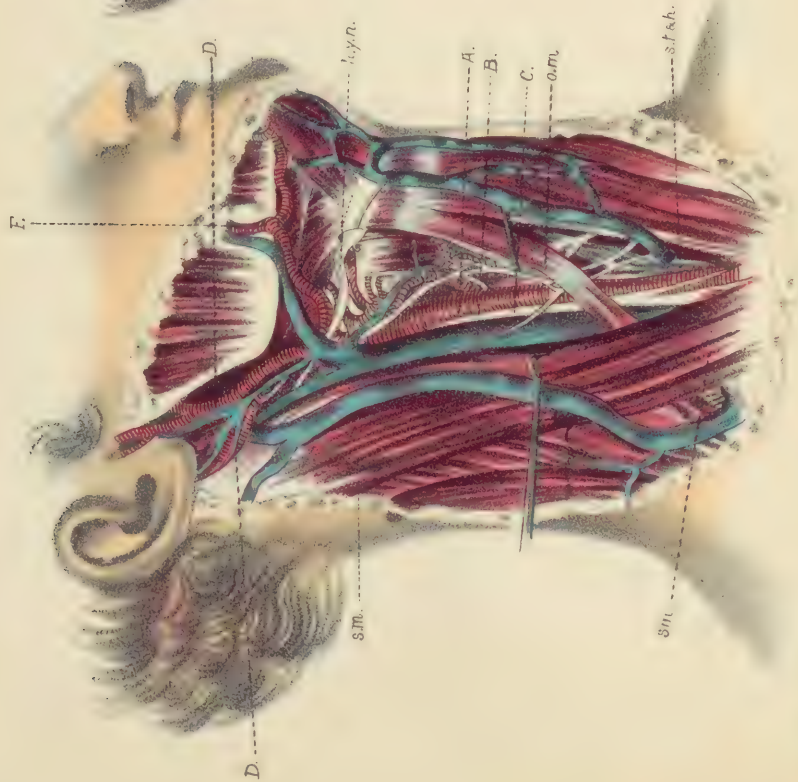
(f) Absence of clothing.

(g) Previous injuries and diseases, as bruises, wounds, inflammations.

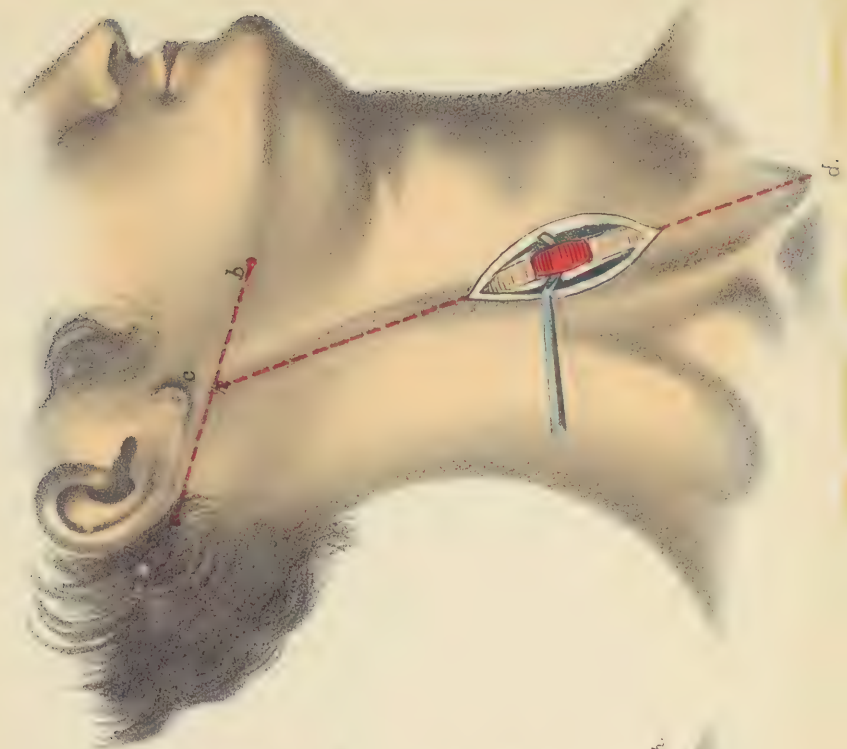
(h) Sudden death.

PLATE IV.

I.



II.



- (i) Acute diseases, especially peritonitis.
- (j) Childhood according to Orfila, the female sex—especially after childbirth.
- (k) Corpulence.
- (l) Animal poisons, prussic acid, and some of the poisonous gases.

PLATE IV.

Figure II. gives the guide marks for opening the carotid artery for injection, viz.: Take one-half the distance between the lower angle (*b*) of the jaw and the bony prominence back of the ear (*a*) and from this point (*c*) carry a line to the junction of the collar and breast bones. The artery as shown in the cut is most conveniently opened at a point just below the level of Adam's apple.

EXPLANATION OF FIGURE I.

- A. Primitive Carotid extending from bifurcation of the innominate to the upper border of the thyroid cartilage.
 - o. m.* Omo-hyoid muscle.
 - st. and h.* Sterno-hyoid and sterno-thyroid muscles.
 - s. m.* Sterno-mastoid muscle pulled aside with a hook to show relation of vessels beneath.
- B. Internal jugular vein.
- C. Pneumogastric nerve behind vein and artery and in same sheath.
- D. and D. Internal and external carotids.
 - hy. n.* Hypoglossal nerve.
 - F. Facial artery.

SECTION IV.

BACTERIA AND CHEMICAL PRODUCTS OF THE DECOMPOSITION OF
THE HUMAN BODY.

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BACTERIA AND CHEMICAL PRODUCTS OF THE DECOMPOSITION OF THE HUMAN BODY.

THE last and the most important of the causes of putrefaction as is now believed, is the development upon the surface of a dead body of vibriones and bacteria—*monas crepusculum* and *bacterium termo*. The history of their discovery is somewhat long, but it so fully covers the various explanations of putrefaction that we reproduce it mainly from Paulet.

History: The earliest explanation of putridity was that of Becker, who taught that the decomposition of a body was occasioned by an astral fire; and according to him a healthy man resists these alterations by the balsamic spirit of his blood, or that property of the living body to which Van Helmont gave the name *l'archee*, or, as we now call it, vital force. Becker also believed in spontaneous generation, or that the flesh of a duck could give birth to an owl and the spinal cord to serpents; and taught that a dead body attracts from the air the microscopic eggs with which it is charged, for "the air," he says, "is the common womb of these new generations." Van Helmont was the first to observe that the presence of air was indispensable to fermentation and decomposition; and secondly, that an air or gas escaped from matters in decomposition. Stahl was the first to divide fermentation into three varieties, viz.:

1. Alcoholic fermentation.
2. Acetic fermentation.
3. Putrid fermentation.

(George Ernst Stahl, the originator of the phlogiston theory in the last part of the seventeenth century, (1660), was the first who claimed that vinous fermentation and putrefaction are phenomena of the same order. He announced that fermentation was a process starting from the well-known infectious nature of putrefaction, and explained both as disturbances in the "molecules" of the fermenting body, bringing about a pre-existing molecular motion.

In 1680, a Dutch philosopher by the name of Antony von Leuwenhoek, accidentally examined some yeast with the microscope, and found it

to consist of minute globular, or oval patches. Microscopes in those days were very imperfect, or he would have made greater discoveries than he reported September 14, 1683, to Asten, member of the Royal Society London. His letter notes that by the means of the microscope, in the white matter taken from between his teeth, he had found "animalculæ of graceful motion," etc. He also distinguished and described several varieties which may even now be readily recognized: and nine years later, (1692), he sent drawings to London which are still extant.

McBride and Pringle in England, Haen in Austria, and Gabert in Turin, next undertook experiments by what we should now consider rude methods, to investigate putrefaction. Their mode of operation was about the same for all, viz.: they allowed decomposition to set in in slices of raw beef, cerebral matter, or urine, and then carefully studied the products which were thus formed. On the other hand before decomposition had commenced they added to these substances agents which they supposed would hinder or prevent it. The work of Pringle and McBride in 1750 excited so lively an interest in France that the Academy of Dijon in 1767 offered a prize to the author of the best monograph on antiseptics. From a number of memoirs then presented only three were chosen, rewarded and published, the first prize given to Boissieu of Lyons, the second to Bordenave of Paris, and the last to Godard of Verviers. Many of the hypotheses then advanced have since been abandoned; as for instance, the theory that astringents owed their powers to their ability to close organic pores, and that substances so treated became less inaccessible to air and were thus preserved from corruption, but the work is still valuable and contains full descriptions of many substances still included among the most reliable of the antiseptics, such as the salts of mercury, copper and iron. Bordenave describes carefully in his essay powdered nut-galls, cinchona bark, alum, salts of tartar, blue vitriol, nitrate of lead, acetate of lead, sulphate of iron, nitrate of silver, and Boissieu adds to these balsam of Peru, camphor and Burgundy pitch. A little later Fourcroy took up the work with especial reference to the metallic salts and their reactions as antiseptics. About 1770, chemistry began to ask these preliminary questions: Is the gas given off from decomposing organic material acid or alkaline? Two camps immediately formed themselves, one to defend the alkalinity, and the other the acidity of these emanations, and a sharp discussion was carried on by the contemporaries of Lavoisier, Fourcroy, Halle and Guyton De Morgeau, which stirred up the passions of even those savants themselves. The majority of the experiments carried on at this time were made with pieces of flesh under a bell glass, or even in bottles; and from these some of the experimenters concluded that air is indispensable to the decomposition of organic matter; while others, like Dr. Mannors at Philadelphia,

and Thompson in England, declared that air played no part in these phenomena. Pringle thought that alkalies, so far from being a product of decomposition prevented it. Gabert answered Pringle very shortly that his experiments had not permitted the evolution of ammonia, because this was set free only at the end of decomposition, and that the alkalies could not be considered antiseptic. DeHaen then made some comparative experiments, placing in a flask fresh urine to which he added ammonia, then in another flask he placed an equal quantity of the same urine, and in a second sulphuric acid, while to a third he added nitric acid, and proved that in the two latter flasks the urine remained the longest unaltered.

Marcorell published in 1782 the satisfactory results obtained by the milk of lime in arresting decomposition of animal matters. Finally Halle, in his work on the Nature and the Effects of Mephitism, brought the two parties into accord, for he showed that there was at the same time the production of acid and alkaline gases, viz: carbonic and ammoniacal. Next came the discoveries of Leuwenhoek with the microscope in 1680, already described on page 238, after which, about 1838, Schwann and Cagnard Latour, by the use of better instruments, discovered that Leuwenhoek's globules were membranous bags, and exhibited all the morphologic characteristics of vegetable cells, and like them, when brought under the proper conditions, increased and multiplied (by division of themselves).

Taking this, together with the well known fact, that in vinous fermentation the yeast increases as the process progresses, they concluded that yeast was a species of plant, and that it is this plant, somehow or other, which causes the chemical change called vinous fermentation.

Schwann, for the purpose and principal aim—first, to solve the great question of spontaneous generation, and also for the purpose of demonstrating that putrefaction and fermentation were processes of similar characteristics, a fact he was at this time quite satisfied of,—tried a number of highly interesting experiments, and proved that *bacteria* performed the same office in putrefaction that yeast does in vinous fermentation.

He prepared infusions of flesh and other putrescible matters, in glass flasks, and after having hermetically closed them, exposed them to the heat of boiling water, so as to destroy every trace of living germs that might be present. He found that the contents, when kept in that condition for any length of time, showed no signs of putrefaction, or of animalcular or germ life. But when exposed to the air, they did putrefy, and soon swarmed with living organisms of various kinds. Obviously it was either the air or substances floating therein that caused this two-fold change. And to determine this question he tried another

set of experiments. He allowed the boiled infusions to communicate freely with the atmosphere, in such a manner, however, that no particle of air could enter the flask, without having first passed through a red-hot glass tube, and thus freed from any germs that might float in it. In this case the air had fair play in a chemical sense, but yet no life of any kind made its appearance, and even the chemical changes failed to set in. Exactly similar results were obtained by him in experiments with grape juice, whether previously mixed or not with yeast. These experiments demonstrate the fact, that the process of putrefaction is not only analogous to fermentation, but that putrefaction cannot take place without the access of the living germs constantly floating in the atmosphere. But he carried his experiment still further. For instance, he found that white arsenic (arsenious acid) and corrosive sublimate being poisonous to both plants and animals, stop both putrefaction and fermentation, while extract of nux vomica, being destructive to animal but not of vegetable life, prevents putrefaction, but does not interfere with vinous fermentation.

Justus Liebig published a memoir in 1848 upon the subject of fermentative changes, in which he reviewed and brought into a more definite form Stahl's theory. He too considered all "fermentations" and "putrefaction" as analogous phenomena, but considered yeast a "purely accidental phenomenon" in vinous fermentation, and thought its power of promoting the fermentative process was owing to the unstable albuminoid substances it contained.

Schroeder and Dusch, in 1854, proved by an extensive series of experiments, that the *something* in the air which enables it to start fermentative changes in boiled infusions of meat, etc., can be effectually removed by filtration of the air through cotton wool.

These experiments carried on during the first half of the present century, proved that the intervention of air was not indispensable to putrefaction, but that the contact of a ferment with a putrescible body was sufficient to bring about the decomposition of the latter. Gay Lussac combated this opinion, and attempted to prove that without air or oxygen, vinous fermentation could not begin, for, said he, grape juice shut off from access to the air, as in a test tube over mercury, does not undergo fermentation; but if a few bubbles of air or oxygen are passed into it, fermentation begins and manifests itself by the evolution of carbonic acid gas, and this gas occupies exactly the same volume as that of the oxygen which has been absorbed. These experiments seem to make a ferment and are the two corner-stones of the edifice of fermentation and putrefaction.

But, suppose we admit that in this fermentation of the grape juice the ferment pre-exists in the pulp of the fruit, and for this purpose let

us examine the beer yeast, or the ferment which develops in a saccharine liquid during alcoholic fermentation. The study of this substance, commenced by Lavoisier and continued by various chemists, was taken up in 1836 by Cagnard-Latour. His researches demonstrated that beer yeast is composed of granules of nitrogenous and albuminous matter, and if these granules are introduced into a saccharine and albuminous liquid, that this albuminous fluid serves for the nutrition and reproduction of these yeast granules. They reproduce themselves by gemmation, giving birth on their surface to new globules which rapidly increase in size, and give birth in turn to new globules. These globules are living, since they multiply themselves and partially transform sugar into carbonic acid. If the saccharine liquid does not contain albuminous matter, the ferment still brings about fermentation, but then the yeast consumes itself in place of multiplication. Fermentation, then, is the result of a vital act performed by the granules of a ferment.

Experiments carried on in Germany next brought the German savants to the following conclusions:

First—The oxygen of the air and a ferment are indispensable to fermentation.

Second—The ferment is always albuminous matter possessing a large number of constituent elements which have a strong tendency towards disassociation.

Third—The elements which thus set themselves free re-group themselves in the form of vapors and gases, and communicate to neighboring molecules, a like tendency towards disassociation.

The drift, however, of later experiments seems to show that it is not a gas but rather a dead substance which determines these changes; "living its own life at the expense of superior beings." (Mojan.)

This living matter seems to exist in the form of organic dust floating in the atmosphere, which aerial dust floats in considerable quantity in the atmosphere, especially during the summer, and plays a very important part in all fermentation and organic decomposition.

This dust can frequently be seen by the naked eye in a dark room in which a single ray of light is allowed to enter, in which it may be seen to float hither and thither as minute particles.

Undoubtedly these are the same as the corpuscles vaguely and mysteriously suspected, perhaps, by Vincent Deauvais, and later directly accused by Becker, and finally fully demonstrated by Schwann in 1837. In this year Schwann related to a Society of Natural History of Jena this important experiment, namely:

That animal substances could be preserved without alteration so long as they remain in calcined air, or that from which these organic corpuscles had been burnt out. It was, however, reserved for Louis Pasteur

between 1857 and 1881 to make an exhaustive study of the organized dust contained in the air, and to exactly describe the part that it takes in the phenomena of organic decomposition. He also discriminated between true ferments and the germs of ferments. Atmospheric dust is made up in the greater part of earthy matter mixed with organic debris, to wit: Microscopic spores and infusorial eggs which latter are, according to M. Pasteur, the prime agent in decomposition. Oxygen is not the motive agent in these decompositions as affirmed by Gay Lussac, neither does the nitrogenous atoms of the atmosphere play the important part in decomposition, but these minute organisms which possess a frightful power of multiplication. (See page 230.) Moreover he showed that the oxygen of the air is powerless to bring about these alterations if the corpuscles that it usually contains are eliminated or incinerated. In 1864 the French Academy chose from itself a commission which repeated the experiments of M. Pasteur and proved their exactness by taking a flask filled with calcined air and attaching it to a tube, whereby a partial vacuum may be produced. By a proper arrangement blood may be drawn from a living animal directly into such a flask without coming in contact at all with the air and such blood does not undergo putrefaction, provided the air in the flask had already been brought to a red heat.

Further experiments conclusively proved that the development of putrefaction took place, not from the gaseous elements of the air, but from something that they allowed to fall from them in a vertical direction, for sterilized fluid placed in a flask with a long neck laid sideways did not undergo putrefaction until the neck was allowed to stand upright and open to the air. To isolate this matter M. Pasteur forced the aspirated air through a tube filled with gun cotton, which is entirely soluble in ether, and this solution showed on the slide of a microscope bodies evidently organized. A fresh grape washed in distilled water by the same experimenter, gave to this water a multitude of yellowish organized corpuscles resembling the spores of moles or of the yeast plant, and like them, easily defined by the microscope. If now the pulp of this grape after its washing is placed in a glass flask containing calcined air it does not ferment, but if you add to it a few drops of this wash water the *micoderma vini*, or grape ferment, appears and fermentation begins: if, however, this wash water has been previously subjected to boiling, no fermentation ensues from the contact of the water whose properties have been modified by a temperature which kills the germs. In general as vitality departs, germ life commences. Minute fungi, the germs which are from one twenty-thousandth of an inch in diameter up, so small that they float on the air scarcely influenced by the force of gravitation, so minute that they pass into the substance of the wood with the sap, and even penetrate the bark, leaves and stump; and with that they remain

an indefinite period inert and then can be called into sudden vitality by atmospheric changes favorable to their germination, are well known facts. The marvelous rapidity with which they multiply is simply wonderful, a single plant producing millions of these reproductive bodies." Such is the modern theory of putrefaction and zymotic disease, hereafter to be more fully described. (See Diseases), at which time we shall attempt to describe other varieties of bacteria. For the present we shall confine our description to the forms met with in butyric, ammoniacal, and lactic fermentations, all of which occur in the dead body; and for this purpose we shall quote freely from Schutzenberger's comprehensive work on Fermentation.

A. PUTREFACTION BY OXIDATION.

"The oxidation of dead tissues was usually supposed to occur without the intervention of bacteria, until Pasteur succeeded in showing that in the well-known phenomena of putrefaction many facts, supposed to be due to oxidation only, are accomplished by the aid of the lower forms of life. The first of these is butyric acid fermentation, hereafter to be considered, and the second is what has been named *eremacausis*, or slow combustion.

"Slow combustion, according to Pasteur, is due to bacteria, mucors, and mucidines, that is to say, vegetable ferments, which, like the vinegar ferments and others, possess the remarkable property of exciting the oxidation of a great number of organic principles, such as sugars, alcohols, organic acids, albuminoids, nitrogenous matter, etc., at the expense of the oxygen of the air.

"After having proved, by careful experiments, that spontaneous slow combustion of animal or vegetable substances depend necessarily on the development of organisms in the interior, or on the surface, of the substances which are in process of decomposition, and that without these organisms there is neither combustion nor absorption of oxygen, Pasteur thus traces the course of putrid decomposition in contact with air. Even the most easily decomposed animal matter as, for instance, blood or urine, may be preserved for an indefinite length of time in air which has been calcined or deprived of its germs; under these conditions the absorption of oxygen is but trifling, and putrefaction does not take place; and at the same time no infusoria are produced. If, on the contrary, this same substance remains exposed to the ordinary air, it is oxidized, putrefied, and infusoria are developed. It is commonly known that putrefaction takes a certain time to declare itself, a period varying according to the circumstances of temperature and the neutral, acid or alkaline character of the liquid. Under the most favorable circumstances, at least twenty-four hours are required before the phe-

nomenon begins to manifest itself by external signs. During the first period internal movement takes place in the liquid, the effect of which is to withdraw entirely the oxygen of the air which is in solution, and to substitute for it carbon dioxide gas. The total disappearance of the oxygen, when the medium is neutral or slightly alkaline, is generally due to the development of the smallest kinds of infusoria, especially the *Monas crepusculum* and the *Bacterium termo*. A very slight troubling then takes place, because these little beings pass about in all directions. If the vessel containing the putrescible liquid has a large opening to the air, the bacteria perish only in the liquid mass after the removal of the oxygen, while they continue, on the contrary, to propagate, *ad infinitum*, on the surface, because it is in contact with the air. There they cause a thin film to form, which goes on thickening by degrees until it falls to the bottom of the vessel; then another forms, and so on continually."

This film, to which different mucors and mucidines are attached, prevents the solution of oxygen gas in the liquid, and consequently allows the development of vibriones. With respect to these latter organisms, the vessel is as if it were closed against the introduction of air.

Thus the putrescible liquid gives rise to two distinct kinds of chemical reactions, one consisting of the transformation of nitrogenous matter in the interior of the fluid into more simple compounds by the action of the vibriones which thrive by the oxygen of air. The second is due to bacteria (or the mucors), which consume these same products, and bring them to the state of the most simple ordinary combinations, water, ammonia, and carbon dioxide.

The compounds which longest resist slow combustion are the fixed fatty acids, forming the adipocere of the old chemists; cellulose, or its derivatives formed by dehydration, such as ulmic acids, vegetable mold, peat, etc.

The oleic acid, on the contrary, disappears altogether. But little is known of the details of these various phenomena of slow combustion.

Fully as important as oxidation in the destruction of the body is that form of decomposition to which has been given the name of

B. AMMONIACAL FERMENTATION.

or putrefaction, for we have already learned that ammonia is one of the invariable products of albuminoid decomposition (See page 258). The influence of bacteria in this is well shown in the case of urea, which, if pure, may be kept in aqueous solution for a long time unchanged; but this does not happen in the urine which contains salts and other nitrogenous principles very similar to albuminous substances, as well as urea.

After a longer or shorter time, according to the conditions of temperature, and the state of health of the individual who has excreted the urine, this liquid, after its emission, becomes alkaline, instead of acid as it was before; at the same time it exhales a very decided odor of ammonia; at this moment the urea has disappeared entirely; we find in its place an equivalent quality of ammonium carbonate. (See page 143.)

In certain cases the urine is already alkaline and ammoniacal, when in the bladder.

According to the observations of Müller and of Pasteur, the transformation of urea into ammonia and carbon dioxide is due to the intervention of a special organic ferment, produced by one of the *Torulacii*, formed of chaplets of globules very similar to those of beer-yeast, but much smaller: their diameter is about one five-thousandth of a millimetre (.0000078 in.) M. Von Tieghem has very thoroughly studied this ferment, which is found in the white deposit left at the bottom of urinals.

Long study of the organic products which are developed in urine exposed to the air, has convinced M. Von Tieghem of the constant presence of a torula whenever urea ferments; and of the intimate connection which exists between its easy or difficult development, and the rapid or slow transformation of the urea. We quote his own words on the subject.

"In the case, seldom realized, in which the torulaceous growth is developed alone, the liquid remains limpid, the fermentation is rapid, and the deposit which forms at the bottom of the vessel is composed exclusively of urates and of ammonium-magnesium phosphates. If the torulaceous growth is only accompanied by infusoria, as is usually the case, the fermentation, though somewhat slower, is still easy; but if there appear, besides the infusoria, vegetable productions in the liquid and on the surface, the torulaceous growth is developed with difficulty, and the transformation is very slow; the liquid may remain acid or neutral for months together.

"The transformation of urea in urine is therefore correlative to the life and development of an organic vegetable ferment. This ferment is developed within the liquid itself; and especially at the bottom of the vessel where, by its accumulation, it forms a whitish deposit, and is composed of chaplets, or small masses of spherical globules, without granulations, without any distinct envelope of the contents, and which appear to develop by budding; their diameter is about .0015 millimeters (.000059 in.)"

M. Von Tieghem considers that he has also proved by direct experiment that the splitting up of hippuric acid by hydration, into benzoic acid and glyecol is due to a fermentation analogous to that which splits up the urea. The active ferment must be identical with the ammoniacal

ferment. Thus ammonium hippurate dissolved, either in yeast-water or in a solution of sugar containing phosphates is always split up in consequence of the development of a microscopic vegetable organism identical with the torulaceous growth described before.

According to Müller, the activity of the phenomenon is proportionate to the number of globules; when to a mixture of sugar and urea, dissolved in water, we add beer-yeast, we always see the small globules of ammoniacal ferment make their appearance, as soon as the liquid shows an alkaline reaction.

The yeast of beer, by itself, decomposes the sugar without exciting the decomposition of the urea. The most suitable temperature is that of the human body, 99° F. (37° C.).

Finally, it has been proven that the ferment does not preëxist in the urine; it must, therefore, be brought from without, in the form of germs, as we also observe in the more complex compounds, known under the name of ureids, in which the molecule of urea is associated with other organic groups, such as uric acid, alloxan creatin, etc.

C. BUTYRIC FERMENTATION.

A great number of chemical compounds are susceptible of fermenting butyrically, that is to say, yielding butyric acid as a product of their transformation, when they are placed under suitable conditions.

Such are lactic acid, and all substances capable of undergoing lactic fermentation—sugars, amylaceous matter, tartaric, citric, malic, mucic acids, and albuminoid substances.

In M. Pasteur's opinion, butyric decomposition is due to the presence in the liquid of a special ferment—*fermentum butyricum*, thus described: "Butyric ferment is composed of little cylindrical rods, rounded at the extremities, usually straight, either isolated or united into a chain of two, three or four joints, and even of more. The diameter of these small rods is generally $\frac{2}{1000}$ of a millimetre, and the length of the isolated portions from $\frac{1}{1000}$ to $\frac{2}{1000}$ of a millimetre. (.0000687 to .000687 inches.) These organisms move forward by sliding. During this movement their body remains rigid or undulates slightly; they spin round, they balance themselves on end, and agitate their extremities; they are often bent. These singular organisms are reproduced by fission. The butyric ferment is, therefore, an infusorium of the genus vibrio."

The same writer has ascertained that this ferment, placed in a solution of sugar containing phosphates and ammoniacal salts, reproduces, and causes butyric fermentation.

The most favorable temperature is 140° F. (40° C.). The medium should be neutral or slightly alkaline. An acid medium is opposed to the development of the germs of butyric fermentation. However, when

once formed, they can live and excite the decomposition of sugar or lactic acid in an acid medium, provided there be no excess of acidity. M. Pasteur first asserted that butyric vibriones not only lived without free oxygen, but that oxygen kills them. The respiratory theory of fermentation proposed by this observer, however, does not agree with this fact. If fermentation is the result of such a need of oxygen, that the ferment takes it up from organic compounds exciting their decomposition by a rupture of equilibrium, we cannot understand how oxygen can act as a poison to the ferment. I do not know whether M. Pasteur has since maintained the opinion that oxygen kills butyric vibriones."

The conditions of nutrition of butyric ferment are, according to Pasteur, the same as those of ferments in general. However, considering its tardy appearance, as compared with lactic ferment, in mixtures which undergo lacto-butyric decomposition, we may admit that it requires albuminoid substances in a process of more advanced change for its nourishment.

D. PUTRID FERMENTATION.

Albuminoid substances and bodies allied to them, which enter into the composition of living organism, have for a long time, enjoyed a special reputation for instability, which varies, however, according to the nature of the substance, for as soon as the influence of life is withdrawn (the vital force which alone was able to maintain them in their integrity), these products begin to be transformed, to change, and to be decomposed into several principles, among which are found compounds with a strong and putrid odor. The researches of Appert on the preservation of animal substances, and those of Gay Lussac on the fermentation of grapes, had given the idea that the momentary intervention of oxygen is necessary to excite the first step in this decomposition. This initial impulse once given, the phenomenon of decomposition goes on spontaneously; and the organic matter in process of transformation is even susceptible of transmitting the molecular movement with which it is imbued, to more stable bodies, such as sugar, which of themselves undergo no modification. This is, as we have already seen, the theory of fermentation borrowed by Liebig from Stahl and Willis, with certain modifications of form.

However, Schwann had shown that the greater part of bodies subject to decomposition, when heated in a retort with water so as to drive out all the air by boiling are no longer decomposed, if instead of allowing ordinary air to enter the retort as it grows cold, we are careful only to admit air previously subjected to a red heat. Under these conditions, putrefaction does not make its appearance, and we no longer observe the development of infusoria and mildews.

The abundant presence of infusoria and mildews in putrefaction had been long known, but it was not thought that these microscopic beings were the true causes which determined the decomposition. They are developed, it was said, owing to germs brought by the air or already contained in the decomposing bodies, or by spontaneous generation, and because they find a soil favorable to their nutrition. The bond between their appearance and putrefaction was one of concomitance.

Schwann and the other authors quoted above, thought, on the contrary, that the germs of infusoria and of mildews set up putrefaction by their development; and as a proof of this, they brought forward their experiments, in which putrefaction was no longer produced, when the preëxistent germs were destroyed, and their introduction by means of the air was prevented.

As the calcination of the air gave rise to some objections, especially to that of a possible change in the constituent principles of this gaseous mixture, Schroeder and Th. V. Dusch repeated Schwann's experiments, with this difference, that instead of allowing calcined air to re-enter the retort in which the organic substance had been boiled, they simply filtered the air through a sufficiently thick layer of cotton wool; they thus succeeded in mechanically arresting the germs and solid matters held in suspension, but without influencing in any way the properties and the composition of the air. The wort of beer, broth, meats recently boiled in water are then preserved very well, even during summer heat.

Some contradictory facts, however, lent support to the arguments of the adversaries of the theory of putrefaction under the influence of infusoria. Thus, the authors of the before-mentioned experiments had themselves ascertained that milk recently boiled coagulates, grows sour, and putrefies, just as well in air that has been strained as in ordinary air; meat not steeped in water, but simply heated in a water-bath, is also not preserved in strained air. In these two cases we observe neither infusoria nor mildew, and yet decomposition is produced.

It is then evident, it was said (Gerhardt), that it is indeed the air which brings and deposits in matter, in a state of putrefaction, the germs of organisms, but it is not less certain that these are not the first cause of decomposition, since it can be produced without their intervention. If the calcined or strained air is less active, in many experiments, than ordinary air, it is because not only are the germs of infusoria removed by these operations, but also the remains of decomposed matter which are suspended in it; that is to say, ferments whose activity would be added to that of oxygen.

The question was in this state when Pasteur resumed the study of putrefaction, by looking upon it in the same light as had guided him in

his researches in fermentation. Guided by the idea that all these phenomena can be explained by the presence, the development, and the multiplication of microscopical plants or animals, he sought to prove that some of these exist also in the putrefaction of animal, nitrogenous substances.

These experiments were conducted by two methods which lead to the same end and confirm each other.

“On the one hand they tend to show putrefaction is always accompanied by the presence, the development, and the multiplication of infinitely small, organized living beings; on the other hand, they prove that whenever we place ourselves under conditions calculated to avoid the presence of the germs of organisms, at the commencement of the experiment, decomposition does not take place even in *products the most liable to it*.

“By the precision of these experiments he removed the objections raised by the partial decompositions noticed by his predecessors, Shroeder and V. Dusch, and which we have mentioned before. Many trials made by Pasteur lead to a positive solution of the question, for by preventing contact of the germs with animal matter, we prevent, at the same time, every trace of fermentation from showing itself.

“M. Pasteur distinguishes two orders of phenomena in putrefaction: some are produced under the influence of organic ferments which live without the aid of oxygen, like butyric ferment; in others, on the contrary, the oxygen takes part, as an essential element, promoting combustion; oxidation is also excited by organisms.”

When, in a putrescible liquid containing albuminoid organic matter, the dissolved oxygen has been absorbed, and has completely disappeared under the influence of the first infusoria developed, such as *Monas crepusculum*, and the *Bacterium termo*, “the *vibrio* ferments, which do not require the gas to sustain their life, begin” to show themselves, and putrefaction is immediately set up. It is accelerated by degrees, following the progressive increase of the vibriones. As to the putridity, it becomes so intense, that the examination of a single drop of the liquid, under the microscope, is a very painful task.”

“It follows, from what has been said, that contact of air is by no means necessary for the development of putrefaction. On the contrary, if the oxygen dissolved in a putrescible liquid was not at once removed by the action of special organisms, putrefaction would not take place: the oxygen would destroy the vibriones which would try to develop at first.

“When the putrescible liquid is exposed to the air, we notice the two kinds of reactions simultaneously, there forms on the surface a complete film, composed of bacteria, mucors and mucidines, which excludes the oxygen and prevents its penetrating into the liquid. The vibriones which

multiply there, under shelter of this rampart, transform by fermentation the albuminoid matter into more simple products, while the bacteria and mucors excite the combustion of these products, and bring them back to the state of the least complex chemical combinations." Such is the representation of the whole of the phenomena of putrefaction as drawn by M. Pasteur.

The opinion held by Schwann, Ure, Helmholtz, Schroeder and V. Dusch, and finally by Pasteur, relative to the cause of putrefaction, is corroborated by the very process which is employed to preserve perishable bodies. The conditions of preservation are such as oppose the development of organisms.

Such are the employment of cold, 32° F. (zero C.), and below; or of a sufficiently high temperature. Cooked albuminous matter resists putrefaction much longer, because the germs which were there are destroyed; but decomposition will, nevertheless, show itself, if we do not carefully guard against effects from without. Appert's process, which consists in cooking meat or other perishable substances, in tin boxes hermetically sealed, realizes these conditions. The germs are killed and there is no possibility of fresh ones entering. As, at the same time, the small quantity of air contained in the box loses its oxygen, it has been thought that the preservation depended on this complete elimination of the oxygen at 212° F. (100° C.).

The total absence of water very efficaciously opposes the development of living organisms. Thus we can preserve, as we may say, indefinitely, dried meat and vegetables.

All substances known as antiseptics are also enemies to ferments. Thus common sea salt, alcohol, creosote, carbolic, salicylic acid, and sulphurous acid, the sulphates, potassium salts, the acids, many metallic salts, as those of copper, mercury, iron, aluminum, arsenious acid, prussic acid, lime water, the antiseptic properties of which are well known and have been frequently tried; all these are also poisons to ferments of various kinds in the quantities in which they are active. (See Antiseptics.)

The preservative action of oil, grease, ashes, fine sand, bran, sawdust, coatings of paraffin or gelatine, is explained by these porous or impermeable bodies preventing the approach and access of germs brought by the air, like the cotton wool in Schroeder's experiments.

PRODUCTS OF PUTREFACTION.

The products of putrefaction are numerous. This may be easily understood, first, because the putrid change of an organ or liquid directly taken from the animal or vegetable economy is the resultant of the decomposition of the various constituents which are found in it. The

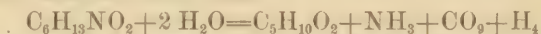
special study of the products of putrefaction of each particular albuminoid substance has only been attempted in a very few cases.

In the second place, the compounds, definite in composition, which undergo putrid fermentation, are so complex in their constitution, that we ought to expect to meet with a great number of derivatives formed by putrid decomposition.

The most constant products which make their appearance in putrefactions protected from the air are leucin, and probably some of its homologues, tyrosin, the volatile fatty acids of the series $C_nH_{2n}O_2$ (formic, acetic, propionic, butyric, valerianic, caproic, etc.), ammonia, and some compound ammonias (ethylamine, propylamine, amylamine, trimethylamine), carbon dioxide, sulphuretted hydrogen, hydrogen, and nitrogen.

We shall refer later to the decomposition of albuminoid substances, etc. The albuminoids contain the elements of urea, and ought to be considered as compound ureids. This fact alone explains the appearance of carbon dioxide, and of a part of the ammonia. (See ammoniacal fermentation.)

The albuminoids are decomposed by hydration under the influence of baryta, etc., furnishing leucin and some of its homologues, tyrosin and a sulphide. These first products may, probably, undergo the ulterior action of ferments, and yield ammonia and volatile fatty acids. We know, in fact, that in presence of putrefied fibrin, leucin is resolved into ammonia and valerianic acid thus:



Everything leads us to believe that putrefaction is a complex phenomenon—that it is only a successive series of fermentations exerted on more and more simple products.

Thus, for example, when we leave fibrin to spontaneous decomposition, without access of air, it is resolved into principles, as under the influence of sea salt. One of these principles is albumen, which, on account of its greater resistance to the action of ferments, will be found for a long time in the putrid liquid. The second product of this decomposition, undergoing somewhat quickly a more thorough change, yields acetic, butyric, valerianic and caproic acids, as well as ammonia, which are evidently derived from the amido-acids, homologous with leucin.

The chemical reactions which accompany the putrefaction of the albuminoids are then, for the most part, phenomena of hydration, which may be reproduced identically by chemical forces alone, independently of vital action. Thus we shall see that phenomena of this kind may be excited by the action of soluble ferments; and we are induced to suppose that a part, at least, of the transformations undergone by proteids, and their more immediate derivatives, are the consequence of phenomena of this order (indirect fermentation).

“ Nothing resembles fermentation, with reference to the derived products, more nearly than the change which takes place in the constituent parts of yeast, when left to itself without nourishment, deprived of sugar and oxygen.

“ We see, in fact, the appearance of leucin, tyrosin, sarcine, etc. This is the first step; the action stops there, and goes no further; the yeast, or the special soluble ferment which it secretes, is unfit to attack these bodies again; but if we wait for the development of vibriones, we shall find the production of ammonia, carbon dioxide, and volatile fatty acids at the same time that leucin partly disappears.

“ M. Ulysse Gayon has published quite recently as a thesis for the ‘ Doctorat des Sciences,’ the result of many experiments on the spontaneous decomposition of eggs. The question was important, and very interesting to the adversaries of the theory of spontaneous generation. Besides, the facts observed by M. Donné and M. Béchamp on the subject seemed contrary to the ideas of M. Pasteur on the general cause of putrefaction. M. Gayon, a pupil and demonstrator of M. Pasteur, endeavored to bring the spontaneous decomposition of eggs and their putrefaction under the general law enunciated by his teacher.

“ M. Donné had read ‘ If we take eggs in their natural state, not shaken, and leave them to themselves they remain for weeks and months, even during the great heat of summer, without undergoing any putrid decomposition. The egg has no unpleasant smell, and nothing possessing either animal or vegetable life is produced, either on the surface of the membrane or in the inside; there are no traces of infusoria or microscopical vegetation.

“ If, on the contrary, we destroy the physical structure of the interior of the egg by shaking; if, that is to say, we break up the texture, and the cells of the albuminous substance, and thus mix together the yolk and the white, then, even without access of the external air, and even guarding against this intervention by extra precautions, such as a coating of collodion spread over the surface of the egg, we find all the phenomena of decomposition make their appearance, after a longer or shorter time, according to the temperature, but always less than a month, all the phenomena of decomposition, with the exception, however, of the production of living organisms, either vegetable or animal; for whatever may be the degree of rottenness to which we allow the egg to proceed, we can never find the slightest trace of animalculæ, or of microscopic vegetable life; the matter of the egg grows troubled and of a livid color; it exhales a fetid odor directly we break the shell, but nothing, absolutely nothing, stirs in its substance; nothing lives, and the most careful and frequently repeated examinations by

means of the microscope does not enable us to discover the least trace of an organized or living being.'"

"M. U. Gayon's experiments, into the details of which we cannot enter, led him to the following conclusions:

"Putrefaction in eggs, whether in the presence or absence of air, is correlative to the development and multiplication of microscopical organisms of the family of *vibriones*.

"In other terms, contrary to the result found by M. Donné and M. Béchamp, eggs make no exception to the great law of correlation, which M. Pasteur has demonstrated for all the phenomena of fermentation, properly so called.'

"We are thus, on the subject of eggs, confronted by two distinct affirmations, as much opposed as black and white. M. Donné found them; M. Gayon did not. We have no balance wherewith to estimate and compare the skill of the two observers. It appears to us certain that M. Gayon saw what he described; but we cannot affirm that M. Donné was absolutely mistaken, and that the eggs, in the conditions under which he placed them, contained vibriones, which he did not find.

"In the absence of any other criterion, we bring forward a very important fact, mentioned by M. Gayon himself.

"This skillful microscopist observed that some of the eggs experimented upon at the temperature of 77° F. (25° C.), whether shaken or not, underwent a special modification, distinct from ordinary putridity and from acid fermentation.

"The decomposed mass is of a dirty yellow color, it has an odor of dried animal matter, and is very fluid; we see in it, also, a great number of needle-like crystals formed of tyrosin. It contains much greater quantities of tyrosin and leucin than are found in ordinary putrefaction. M. Gayon was not able, under these circumstances, to find any trace of microscopic organisms either in the inside, on the surface, or in the substance of the membrane. However, tyrosin and leucin are evident and unquestionable evidence of the decomposition of albuminoid matter.

"Between the production of these substances and the phenomena called putrefaction there is, chemically speaking, no very clear distinction to be drawn. They are reactions of the same order, decompositions, more or less extensive, of the proteid molecules; the traces of sulphuretted hydrogen and other fetid products which communicate such a repulsive odor to putrefaction, cannot serve to establish an absolute and philosophical line of demarcation between the decomposition without organisms observed by M. Gayon, and what is wrongly termed putrefaction properly so-called.

"The result of this seems to be, that albuminoid matters are able to

undergo certain decomposition—certain changes, without the intervention of living organisms.

“By means of a very simple and ingenious apparatus, M. Gayon succeeded in extracting the gas contained in large ostrich eggs in a state of putrefaction.

“One of these eggs, in a state of thorough putrefaction, yielded 150 cubic centimetres of gas, containing per cent :

Sulphuretted Hydrogen.....	Traces
Carbon dioxide.....	30.5
Hydrogen.....	4.02
Nitrogen.....	29.3
	100.0

“The presence of nitrogen might be due to the accumulation of a certain quantity of air in the air-bubble before putrefaction.

“Among the solid and liquid product of the putrefaction of eggs, the presence of small quantities of leucin and tyrosin, alcoholic products, and volatile acids, butyric acid, etc., were recognized. The sugar had disappeared.” (Schutzenberger.)

PRODUCTS OF PUTREFACTION.

And now, at last, we are prepared to review the products of putrefaction, to understand which it requires both the aid of the chemist and microscopist: for putrefaction is due in part to re-arrangement of organic compounds in accordance with the laws of chemistry, and in part to changes produced by bacterial growths. We have briefly considered the latter as fully as the limits of the present section will allow; our remaining space will barely suffice for a brief mention of the more important chemical products arising from the decomposition of a human body. These are very many, for under the proper circumstances each of the hundred or more proximate principles (See page 131–154) become decomposed and give rise to new products. The *inorganic* compounds are the more stable; and with the exceptions hereafter to be noted, as a rule, leave the body in the form in which they enter it; but is very different with organic compounds, especially with the albuminoids and fats, which together constitute about a third (52 pounds) of a normal body, as may be seen by the annexed division of the body according to its proximate principles :

Water.....	95 lbs.
Fat.....	28 “
Albuminoids.....	24 “
Inorganic Salts.....	7 “
	154

The *water* (95 pounds) includes that of the body and its fluids. The part that water plays in the decomposition of the body has already been discussed, so that for the present we need only remind the reader that as a general rule the larger proportion of water, an organ of the body contains, the more rapid its putrefaction. Hence, as might be expected, the fluids of the body other than those which contain natural antiseptics, are those which most rapidly develop bacterial growths, and putrefactive changes. No better instance of this can be found than *mucns* (page 159) which, according to Beale, is a culture fluid for bacteria even during life.

“Every time we eat myriads are carried into our alimentary canal; and every time we breathe, except in the very purest atmosphere, multitudes pass into the air passages. So small are these bacterial germs that they would pass without the slightest difficulty through basement membrane, and through the interstices of any of the tissues of the organism. As a fact, ordinary bacteria are harmless enough; they exist in us without disturbing us in any way, but they only grow and multiply in great numbers when circumstances become favorable. I can give positive proof that bacteria germs exist not only upon the surface of the skin and mucous membrane, but in the internal organs, in the interstices of healthy tissues, and in the blood itself.” Why, then, does not the blood decompose during life? Simply because, if we understand it, it is a vital fluid full of living corpuscles, during whose life putrefactive changes are impossible; but as soon as they lose their vitality putrefactive changes begin, and the first of these is the chemical formation of fibrin (See page 193), which produces the resulting phenomenon of coagulation of the blood. This has already been alluded to, but as it is really the earliest, and to the practical embalmer one of the most important of the changes which occur in the decomposing body, it deserves some little attention at this point.

COAGULATION OF THE BLOOD.

Blood within the body coagulates after death, but more slowly than that drawn from the body during life, especially so in those diseases attended with lack of fibrin, as phthisis, etc. The cause of this coagulation (page 187), and the change in the reaction of the blood from alkaline to acid has already been mentioned (page 186). If, from any cause the fibrin contracts less rapidly than usual (as happens in inflammatory blood), or the red corpuscles sink more rapidly than usual, a white layer collects on the surface of the clot, consisting of fibrin only, or of a mixture of fibrin and white corpuscles. This constitutes what is called a buffy coat, or the inflammatory crust of blood. This buffy coat contracts more rapidly than the rest of the clot. Hence a cup-like depres-

sion on the surface of the clot becomes apparent after a short time. Coagulation is *hastened* by a variety of circumstances, viz.:

Women's blood coagulates more rapidly than the blood of men, but the clot is less firm. Embryonic blood coagulates imperfectly. Arterial blood coagulates more rapidly than venous.

A warmth of 100 to 120 degrees F. (37.8 to 48.9 degrees C.), promotes coagulation. A higher temperature than this retards it, whilst a temperature of 200 degrees F. (93.3 degrees C.), stops coagulation altogether, even after the blood has been cooled. Conversely a cold of 40 degrees F. (4.5 degrees C.), entirely stops coagulation; but coagulation will, under these circumstances, take place as well as ever after the normal temperature of the blood has been restored.

Motion retards coagulation but rest promotes it.

The multiplication of points of contact promotes coagulation. Thus we whip blood with a bundle of twigs to coagulate the fibrin. Or again, the blood coagulates more rapidly in the rough cavities of the heart than in the smooth veins and arteries. Conversely coagulation is *retarded* by a variety of circumstances, some of which have already been mentioned, among which are:

(a). *Cold*, which, according to some experimenters, if sufficient, entirely prevents.

(b) *The addition of soluble matter to the blood*.—Many saline substances, and more especially sulphate of soda and common salt, the alkaline hydrates, carbonates, and acetates dissolved in the blood in sufficient quantity, prevent its coagulation; but coagulation sets in when water is added, so as to dilute the saline solution. The same is true of dilute acids, potassic and calcic nitrates, and ammonia chloride.

(c) *Contact with living tissue* retards coagulation, whilst contact with dead or foreign tissue favors it. Thus we pass a thread through an aneurism to form a nucleus for coagulation and to assist the cure. Blood drawn into a basin begins to coagulate where it touches the sides of the basin and a wire acts like a thread in an aneurism.

(d) *Large dilution* with water retards, if the quantity used is greater than twice the bulk of the blood.

(e) *Exclusion of air* retards, and certain gases apparently prevent entirely.

Coagulation is influenced by the mode of death. Thus in death by asphyxia, where the blood is imperfectly aerated, coagulation is retarded. According to Hunter, the same result occurs in death from lightning, blows on the stomach, over-exertion, fits of anger.

If space allowed, it might be of interest to discuss the further putrefactive changes that take place in the blood and each of the fluids and solids of the body; but we have already so fully discussed them that it will

not be profitable to do more than to give in general the results of animal putrefaction, noticing only such chemical compounds as have not previously been described. The *final products* of all the tissues of the body are the same, viz.: inorganic salts and gases, but this change, as we have already noted, does not take place with uniform rapidity, for all parts of the body are not decomposed at the same time. The bones are less readily acted upon than the integument and the tegumentary substances and membranes are more slowly destroyed than the muscles, and the muscles more slowly than the nerves, while the pigments are the most persistent of all. All of these, as has long been known, when left in contact with air undergo progressive and complex transformations, known under the name of putrefaction, or slow combustion (*eremacausis*), whose effect is to transform them into principles more and more simple by means of decomposition and oxidation; so that, in the end, the carbon is restored to the air in the form of carbon dioxide, the hydrogen under the form of water, the nitrogen either as free nitrogen or ammonia. These gases have all been described on page 136, so that what now remains for description are *Intermediate products*, or those that are formed in the transition from living organized tissue to its ultimate products of gas and inorganic salts. These decomposition products, as may be seen by the following table, are numerous and of the most varied chemical combinations. Ralfe, in his *Pathological Chemistry* divides these compounds into two groups, viz.: (1) the non-nitrogenous organic acids arising from the oxidation of fats, sugars and other carbo-hydrates and, indirectly, from albuminoids, and (2) nitrogenous bases obtained together with the intermediate products already mentioned by the oxidation of albuminoid substances. "This oxidation is rarely finished in one effort, but several intermediate products are usually necessary before the final products are reached." This can be most conveniently shown by the following table which is enlarged from the one given by Ralfe.

INTERMEDIATE AND FINAL PRODUCTS ARISING FROM THE DECOMPOSITION OF CARBO-HYDRATES AND ALBUMINOIDS.

SOURCE.	INTERMEDIATE.	FINAL PRODUCTS.
Sugars, fats, and other carbo-hydrates which form non-nitrogenous acids, etc.	Lactic acid. ($C_3H_5O_3$)	Carbonic anhydride (CO_2). (Page 138.)
" "	Oxalic acid. ($C_2H_2O_4$)	
" "	Succinic acid. ($C_4H_6O_4$)	Water (H_2O). (Page 132.)
" "	Formic acid. (CH_2O_2)	Oxygen (O). (Page 111.)
" "	Acetic acid. ($C_2H_4O_2$)	
" "	Propionic acid. ($C_3H_6O_2$)	Hydrogen (H). (Page 110.)
" "	Butyric acid. ($C_4H_8O_2$)	
" "	Valerianic acid. ($C_5H_{10}O_2$)	
" "	Caproic acid. ($C_6H_{12}O_2$)	
" "	Pelargonic acid. ($C^9H_{18}O_2$)	
" "	Capric acid. ($C_{10}H_{20}O_2$)	
" "	Stearic acid. ($C_{18}H_{36}O_2$)	
" "	Glycerine. ⁱⁱⁱ (C_3H_5) 3OH	Ammonia soap. (Adipocere.)
" "	Glucose. ($C_6H_{12}O_6$)	
II.		
Albuminoid compounds breaking up into nitrogenous bases and non-nitrogenous acids previously mentioned.	Xanthin ($C_5H_4N_4O_2$). (Page 208.)	Ammonium Carbonate. (See page 143.)
" "	Cystine ($C_3H_7NSO_2$). (Page 208.)	Ammonium Sulphide. (NH_4HS .)
" "	Amido-caproic acid. ($C_6H_{13}NO_2$). See Leucin.	Water (H_2O). (Page 132.)
" "	Oxyphenylamido-propionic acid. See Tyrosin. ($C_9H_{11}NO_3$). (Page 157.)	Ammonia (NH_3). (Page 215.)
" "	Hippuric acid ($C_9H_9NO_2$). (Page 208.)	Carbonic dioxide. (Page 138.)
" "	Amido-acetic acid. (See Glucocine.)	

SOURCE.	INTERMEDIATE.	FINAL PRODUCTS.
Albuminoid compounds breaking up into nitrogenous bases and non-nitrogenous acids previously mentioned.	Amido-propionic acid. Amido-butyric acid. Amido-aspartic acid. Amido-glutamic acid.	<i>Ammonia.</i> Carbon dioxide. Water.
Also albuminoids containing phosphorus, such as lecithin ($C_{42}H_{82}NPO_3$).	Trimethylphenyl-ammonium hydroxide (Neurin $C_6H_{13}NO$). Glycero-phosphoric acid ($C_3H_9PO_6$). (See page 182.)	<i>Phosphoretted Hydrogen.</i> (PH_3). (See page 221.)
" "	Urea (CN_2H_4O). (See page 206.)	Ammonia carbonate. (Page 143, etc.)
" "	Uric acid ($C_5H_4N_4O_3$). (See page 207.)	" "
" "	Alloxan ($C_4H_2N_2O_4$).	" "
" "	Allantoin ($C_4H_6N_4O_3$).	" "
" "	Hypoxanthin ($C_5H_4N_4O$)	Water (H_2O).
" "	Leucomaines.	
" "	Adenine.	<i>Hydrogen sulphide</i> (H_2S). (See page 189.)
" "	Ptomaines.	

N. B.—Substances in *italic* are those which impart disagreeable odors to putrefying bodies.

I. DECOMPOSITION PRODUCTS OF HYDRO-CARBONS.

LACTIC ACID.

Synonym: Oxypropionic acid. Formula, $C_3H_5O_3$ Specific gravity, (concentrated solution), 1.215. Graphic symbol, $H-C-COOH-OH-CH_3$.

Origin: Free lactic acid is found in muscle plasma (page 171) giving it its acid reaction and increasing with muscular exertion. It is also found associated with hydrochloric acid in the gastric juice. It is also one of the products of the fermentation of milk and other animal fluids.

Properties: A colorless, extremely acid liquid, of syrupy consistency, which does not crystallize or become solid, but is obtained in solution.

Chemism: Soluble in water, alcohol or ether. The acid discovered in muscular tissue, and designated by Liebig *sarcolactic acid*, has been shown to be a mixture of two acids belonging to the lactic group, but differing from the lactic acid of fermentation. By oxidation lactic acid forms acetic acid, formic acid and carbonic anhydride.

Pathology: It is never found in healthy blood as its salts are there converted into carbonates, unless there is some such disease as dyspepsia or rickets. Its function in the body seems to be to aid in the solution of the salts of lime, and prevent their accumulation in the tissues, also to aid in oxidation and assist digestion. The acid reaction of blood

observed after death is probably caused by the conversion of its sugar-glucose into lactic acid.

OXALIC ACID.

Formula $C_2H_2O_4$, or graphically $HO-CO-CO-OH+2Aq$. *Molecular weight, 90. Bibasic acid forming neutral and acid or binoxalates.*

Origin: Oxalic acid may be formed by the imperfect oxidation of many organic substances. It represents in the body an intermediate stage in the oxidation of more complex substances on their way to form carbonic anhydride and water: but as this change takes place rapidly in the healthy body, oxalates are never met with in the secretions of the body, unless the general tone of the system is impaired, or an excess of carbonates have been taken into the body.

Properties: Oxalic acid crystallizes in transparent prisms, which effloresce in the air, and which are very soluble in water and alcohol, and are very poisonous. (See Poisons).

It fumes at 98° ; at 170° to 180° it is partially sublimed, but the greater portion is decomposed into carbon monoxide, carbon dioxide, formic acid and water. It forms acid and orthoxalates in the system, the most important of which is the oxalate of calcium CaC_2O_4 , which from its sparing solubility is not infrequently found as a sediment in urine.

SUCCINIC ACID.

Synonym: Ethene-dicarboxylic acid. *Formula*, $C_2H_4O_4$. *Molecular weight, 93.*

Succinic acid was first obtained from heating amber in iron retorts: it occurs in some lignites, and occasionally in animal and vegetable substances. It has been found in the parenchymatous fluids of the spleen, and the fluids of hydrocele and hydatid cysts. It appears in connection with the oxidation of many fats and in certain morbid exudations, and in fermenting fluids.

It occurs in colorless, rhombic crystals, which melt at 180° . It has a hot, sharp taste, and is reduced to odorous vapor over hot charcoal. Cold water dissolves one-fifth of its weight of succinic acid. Being distilled with sulphuric acid and manganese dioxide, it yields acetic acid. Not acted upon by nitric or hydrochloric acid.

FORMIC ACID.

Synonyms: Methylic acid, Hydric formate. *Formula*, CH_2O_2 . *Molecular weight, 50.98. Specific gravity, 1.23.*

As seen from its derivation (Latin *formica*, ant) this acid was first obtained from the bodies of red ants. It also occurs in the hairs and other parts of certain caterpillars, and in stinging nettles. It is found in the blood, urine, bile, perspiration, and muscular fluid of man.

A colorless liquid with a strong odor, resembling that of irritated ants. Its corrosive action resembles that of nitric acid; it is inflammable, and burns with a blue flame. Crystallizes in tabular forms at 0° , and boils at 100° , and is freely soluble in water.

With sulphuric acid it is decomposed into water and carbonic oxide. It differs from other acids of its group in having a powerful reducing action upon metallic salts

ACETIC ACID.

Synonyms: Acetyl hydrate, Pyroligneous acid, Hydrogen acetate, Acidium aceticum, Ethylic acid, Spirits of vinegar. Formula, $C_2H_4O_2$. Molecular weight, 60. Specific gravity, 1.08.

Acetic acid occurs in small quantities in animal fluids, and also in the juices of plants. It is formed by the fermentation of alcohol, wine, beer, or by the decomposition, through heat, of various substances, chiefly vegetable.

A colorless, pungent liquid, very strong and corrosive, producing blisters upon the skin. At 17° it solidifies into a white crystalline mass, and boils at 119° . Its vapor burns with a pale, bluish flame. It mixes with water in all proportions, and the volume of the mixture is less than the sum of the volumes of the constituents. The acidity of ordinary vinegar is due to the presence of acetic acid formed by the oxidation of alcohol contained in the original liquid. (See antiseptics.)

PROPIONIC ACID.

Synonyms: Methacetic acid, Propylic acid. Formula, $C_3H_6O_2$. Molecular weight, 78. Specific gravity, 0.996.

Propionic acid is probably formed in the body as a product of oxidation of the fats and albuminoids; its presence, however, has not been demonstrated with certainty, although it has been said to exist in the perspiration, the contents of the stomach, in the vomit of cholera, and in fermented diabetic urine. It is formed during the decomposition of a great number of vegetable substances by the action of caustic potassa upon sugar, gum, etc., during the putrefaction of peas and beans; it is the acid of "turned" wine.

An oily, colorless liquid, which mixes with alcohol and water in all proportions, but is not completely soluble in the latter, forming oily drops. In odor and taste it resembles acetic acid. It can be solidified at low temperature, and boils at 140° . It forms monobasic salts called *propionates* which are soluble and crystallizable.

BUTYRIC ACID.

Synonyms: Ethacetic acid, Tetrylic acid, Diethacetic acid. Formula, $C_4H_8O_2 = C_3H_7CO(OH)$. Molecular weight, 88. Specific gravity, 0.974.

Butyric acid exists free and in "ethers." It occurs in perspiration, milk, juices of spleen and other glands, in guano, fruit, yeast, etc. It is formed by the decomposition of organic substances, as by the action of alkalies upon *butyrine*, a substance contained in butter. A viscid liquid with the odor of rancid butter, very volatile, soluble in water and alcohol. It boils at 162°C . The acid is known in two conditions, both of which are colorless liquids yielding, when heated, acetic acid and carbonic anhydride.

VALERIC ACID.

Synonyms: Valerianic acid, Delphinic acid, Pentylic acid.
Formula, $\text{C}_6\text{H}_{10}\text{O}_2$. Molecular weight, 102. Specific gravity, 0.974

• Discovered originally in the oil of the porpoise, and subsequently in valerian root and angelica root. It is formed during fermentation of albuminoid substances, and occurs in the urine and feces in typhus, variola, and acute atrophy, and is also one of the products of the decomposition of leucin in the presence of putrid fibrin.

Chemism: Valeric acid is an oily liquid, colorless, with penetrating odor and sharp taste. It solidifies at 16° , and boils at 173° . It is soluble in water, alcohol and ether. It dissolves phosphorus, camphor and resins, and forms metallic and ethereal salts called *valerates*, or *valerianates*.

THE HIGHER FATTY ACIDS,

As those are called which contain more than five atoms of carbon, are found in the annexed list. Those are all formed by the oxidation of fats, but only those which have a disagreeable odor and stearic acid are here noted, viz.:

Caproic.....	$\text{C}_6 \text{H}_{12} \text{O}_2$
Enanthylic.....	$\text{C}_7 \text{H}_{14} \text{O}_2$
Caprylic.....	$\text{C}_8 \text{H}_{16} \text{O}_2$
Pelargonic.....	$\text{C}_9 \text{H}_{18} \text{O}_2$
Capric.....	$\text{C}_{10} \text{H}_{20} \text{O}_2$
Lauric.....	$\text{C}_{12} \text{H}_{24} \text{O}_2$
Cocinic.....	$\text{C}_{13} \text{H}_{26} \text{O}_2$
Myristic.....	$\text{C}_{14} \text{H}_{28} \text{O}_2$
Palmitic.....	$\text{C}_{16} \text{H}_{32} \text{O}_2$
Margaric.....	$\text{C}_{17} \text{H}_{34} \text{O}_2$
Stearic.....	$\text{C}_{18} \text{H}_{36} \text{O}_2$
Arachidic.....	$\text{C}_{20} \text{H}_{40} \text{O}_2$
Cerotic.....	$\text{C}_{27} \text{H}_{54} \text{O}_2$
Melissic.....	$\text{C}_{30} \text{H}_{60} \text{O}_2$

these fatty acids, or those containing over five atoms of carbon, are chiefly of interest here from the vile odor of some of its members; the more important of these are: *Caproic acids*, $\text{C}_6\text{H}_{12}\text{O}_2$, and its isomers colorless, oily fluids with the odor of perspiration. *Enanthylic acid*,

$C_7H_{13}O_2$, is a colorless, oily liquid with a vinous odor. *Pelargonic acid*, $C_9H_{18}O_2$, is a colorless oil with the odor of fish geranium. *Capric acid*, $C_{10}H_{20}O_2$, is a crystalline solid with a goat-like odor.

STEARIC ACID.

Stearic acid, $HO(C_{18}H_{35}O)$. If tristearine be boiled with sodic hydrate and the solution be diluted with ten times its volume of water, or if ordinary soda soap be dissolved in hot water and then largely diluted with cold water, a precipitate will fall which will consist of the acid stearate of soda, mixed with the acid palmitate of soda, if soap has been used. This precipitate is treated with boiling alcohol and the solution decanted; when the solution cools the acid stearate is again deposited and should be washed with cold alcohol and then treated with dilute hydrochloric acid. Chloride of sodium is formed and the stearic acid set free; the former in solution is decanted and the latter is redissolved in boiling alcohol from which it crystallizes on cooling.

Stearic acid forms in thin plates, some of which are rectangular while others are oval. They are insoluble in water and cold alcohol; soluble in hot alcohol, ether, chloroform and benzol. Stearic acid has already been alluded to in connection with stearin (page 163) with which it exists ⁱⁱⁱ in connection with glycerine, or more exactly with glyceryl _i (C_3H_5) a triatomic ⁱ radical which unites with hydroxyl (OH) to form glycerine $(C_3H_5)(OH)_3$. •

GLYCERINE.

Synonym: Propenyl alcohol. *Formula*, $C_3H_8O_3$ or $(C_3H_5) \begin{cases} OH \\ OH \\ OH \end{cases}$

Specific gravity, 1.27.

Origin: Glycerine occurs free in palm oil, is produced in small quantities in alcoholic fermentation, and is widely disseminated in animal fats, being in combination with acids and forming neutral substances. It is produced as a by-product in the manufacture of soap and candles.

Properties: A syrupy, sweet, neutral, colorless liquid, soluble in water and alcohol, unalterable from exposure to air, and therefore valuable for preserving animal and vegetable substances. A useful solvent for many substances. When quite pure, and subjected to cold, it may form colorless crystals, which melt at 15.60 C. (See Antiseptics.)

Subjected to high temperature it decomposes, yielding *acrolein*

With nitro-sulphuric acid, it forms the oily, explosive compound, *nitro-glycerine*.

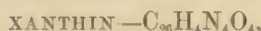
GLUCOSE.

Synonyms: Grape-sugar, dextrose, liver-sugar, diabetic sugar, dextro-glucose, granular sugar. *Formula*: $C_6H_{12}O_6$. *Specific gravity*, 1.4.

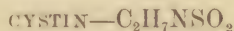
Origin: This substance occurs both in the animal and vegetable kingdoms. It is found in minute quantities in the urine in health, and in diabetes in large proportion, rising as high as 5.8 parts per thousand. It is introduced into the system by vegetable food, and also produced by the liver at the expense of glycogen, a formation which continues for some time after death. (Page 175.) It is also largely formed from starch by treatment with dilute sulphuric acid and neutralizing with chalk.

Properties: Glucose is much less sweet than cane-sugar, as also less soluble. It crystallizes with difficulty from solution in white, non-sparkling spheroidal masses. Its sweetening power is about one-half that of cane-sugar. In solution, glucose turns the plane of polarization of a ray of light to the right (hence the name *dextrose* in contradistinction to *laevulose* which rotates a ray of polarized light to the left). At 170° it gives off water and is converted into *glucosan*. At higher temperatures glucose blackens and suffers complete decomposition. It is rapidly oxidized, and when boiled with alkaline solutions of silver and copper salts quickly reduces them.

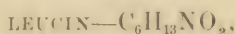
II. NITROGENOUS DECOMPOSITION PRODUCTS.



already mentioned as occasionally found in urinary calculi, (page 208) ought to be here further alluded to since it is one of the more frequent products of the decomposition of the nitrogenous compounds of the body and hence may be obtained from the liver, spleen, thymus gland, muscle and blood. The explanation of its rarity as a constituent of the urine is found in the fact that in a healthy body xanthin is immediately oxidized and appears as a higher derivative from uric acid. For its properties, see page 208.



has also been described previously in connection with the urine, where it occasionally is met with, either as a calculus or as sediment. According to Bence Jones, cystin, like xanthin, is being continually formed during life, but is immediately transformed in health into sulphuric acid, urea and carbonic anhydride. Cystin is a greenish-yellow, waxy substance, without odor, taste or reaction upon vegetable colors, and is insoluble in water or alcohol, but dissolved by the mineral and oxalic acids. Melts easily and burns with a bluish-green flame.



chemically, is an amidocaproic acid, produced in the body by the decomposition of albuminoid matters.

Properties: When properly isolated, leucin appears in pearly, snow-white plates, which are tasteless, odorless and soluble in water, but insoluble in cold alcohol and ether. Its solutions are neutral and its combinations with acids are crystallizable and soluble in water.

Chemism: In the presence of putrefied fibrin, leucin breaks up into ammonia, valerianic acid, etc. Associated with tyrosin it may be obtained from all the glandular organs and their secretions, being especially abundant in lung and liver tissue (See page 208).

TYROSIN— $C_9H_{16}NO_3$

has already been described on page 154. It is an odorless substance, except when burned, and soluble in weak ammoniacal fluids. Chemically it is an "oxyphenyl amido-propionic acid" and is usually associated with leucin in the glandular organs and various secretions.

OTHER AMIDO ACIDS.

There are several other amido acids of the fatty series, viz.: amido-canthylic, amido-butyric and amido-acetic, the last usually known as *glycicoll*, $C_2H_5NO_2$, is one of the decomposition products of gelatinous tissues and may be isolated in the form of large, colorless, transparent crystals, which have a distinctly sweet taste, and may be dissolved in water and dilute spirits. Amido-aspartic and amido-glutamic acids are also known, but are not important. The same might also be said of the other amines, which ought to be alluded to in passing.

ETHYLAMINE.

Synonyms: Amido-ethane, Ethylia. *Formula:* C_2H_7N . *Specific gravity,* 0.6964.

Properties: An alkaloid resembling ammonia in many of its properties. A very mobile liquid, colorless, boiling at 18.7° , with the penetrating odor of ammonia, and giving off an inflammable vapor which burns with a yellowish flame; soluble in water, alcohol or ether; precipitates metallic salts, and produces a blue precipitate with copper salts. With hydrochloric acid it gives off white fumes.

PROPYLAMINE.

Formula, C_3H_9N . *Specific gravity,* 0.7283.

Propylamine is found in nature in the flowers of the white-thorn and in the fruit of mountain ash; herring brine contains it in considerable quantity, combined with an acid, from which it may be separated by distillation with potash.

Properties: A colorless, transparent liquid, possessed of a strong odor like that of ammonia; it is soluble in water, and this solution

shows a strong alkaline reaction, even when much attenuated. Propylamine boils at 50° ; it neutralizes many acids and forms crystallizable salts. Like ammonia it produces white fumes in the presence of hydrochloric acid.

AMYLAMINE.

Synonym: Isopentylamine. *Formula.* $C_5H_{13}N$. *Molecular weight.* 87. *Specific gravity,* 0.7503.

A colorless liquid with strong ammoniacal odor, alkaline in reaction, boiling at 95° .

TREMETHYLAMINE— C_3H_9N .

Produced by distilling codeine or narcotine with potash; also contained in herring brine, the strong odor of which is due to its presence. It is a liquid easily soluble in water, and boiling at 98° . Has the odor of ammonia and fish brine.

Here also belongs chemically

NEURIN— $C_5H_{13}NO$,

a trimethylvinyl ammonium hydroxide which is one of the decomposition products of lecithin (See page 182).

Properties: It is a very deliquescent, difficultly crystallizable base, strongly basic, absorbing CO_2 from the atmosphere, forms crystallizable salts with the acids and platinic chloride.

According to Ralfe, under the head of ammonia, decomposition compounds ought to be placed creatin $C_4H_9N_3O_2$ and creatinin $C_4H_7N_3O$, but they are by many considered normal constituents of muscular tissue, and as such fully described on pages 172-173. Of decomposition products proper, *sarcosine*, $C_3H_7NO_2$ has also been previously considered (page 174), as well as *urea* (page 206) *hippuric* (208) and *uric* acids (207). A few of their intermediate products are given in the table on page 270, and ought to be described as briefly as possible in passing. The more important are:

Alloxan, $C_4N_2H_2O_4$, which may be prepared by the action of strong nitric acid on uric acid; white crystals; very soluble in water; crystals become anhydrous at $150^{\circ}C$; solution acid, and stains the skin red; decomposed by both oxidizing and reducing agents. Forms a deep blue compound when acted on with an alkali and ferrous salt.

Properties: Colorless crystals. Soluble with difficulty in cold water, more soluble in hot. Becomes anhydrous at $150^{\circ}C$. Solution acid, converted by oxidizing agents into alloxan. Decomposed by the prolonged action of H_2S into dialuric acid.

Allantoin: $C_4N_2H_6O_3$. *Properties:* Transparent colorless crystals; soluble in 160 parts of cold water. Decomposed by boiling with mineral acids and caustic alkalies. (See page 209.)

But still more important is the recent discovery of the compound ammonias, or animal alkaloids to which it has been given the names of

PTOMAINES AND LEUCOMAINES.

• In the course of putrefaction in animal tissue, a certain number of poisonous alkaloids are called into existence, and these alkaloids of putrefaction vary according to the character of the medium in which they develop, also to the period when bacteridian fermentation begins. In the excretion of living animals, there are substances of the character of ptomaines. The alkaloids of urine detected by Liebricht and Pouchet, ought to be ranked with alkaloids of putrefaction. There are similar ptomaines in saliva and snake venom, which M. Gauthier names leucomaines, in order to distinguish them from those alkaloids that form in dead bodies which are called ptomaines. In 1881 M. Gauthier published a memoir in which he dwelt on the importance of leucomaines in connection with the genesis of disease, when renal elimination, and that of the skin, and intestinal mucous membrane are insufficient. Later on, M. Gauthier studied the muscular juice of large animals, and extracted five new, definite, crystallized alkaloids acting with more or less energy on the nerve centers, causing sleep, fatigue, and in some instances vomiting and action of the bowels, in a less degree than ptomaines. These substances are called into existence just as are carbolic acid and urea. The transformation of the tissues of the higher order of animals is, in a large proportion, of the anerobic order. M. Gauthier observes that this proposition may appear paradoxical, but he believes that he will demonstrate it both experimentally and theoretically. Four-fifths of the products of animal combustion are positive ærobie formations, comparable to the oxidation of alcohol under the influence of animal life. When we think heat is evolved in the brain, and the material result of cerebral activity is neurin, an alkaloid improper to normal life. (See page 183.) Muscular movement causes heat, the material result being creatinin and other alkaloids improper to normal life. In fine, all the organs which work and which, by working undergo partial destruction, make, besides these alkaloids, extractive matters. Life, then, is also, only a partial and prolonged suicide; and it is easily seen how precarious is the state called "health," and how, even by the action of our own organs, disease may supervene; all that is necessary is the accumulation in our bodies of "cancerized" materials. Such accumulation pre-supposes insufficient elimination, and this may take place in two very different conditions of life. Sometimes the alkaloids and extractive materials are produced in excess, the emunctories remain normal, but are momentarily insufficient for carrying off these substances as fast as they are produced. Or there may be a normal production of these substances, but the emunctories are

morbidly altered or suppressed for the time being." *Journal American Medical Association, No. 10, Pages 268—269.*

The whole subject of ptomaines, leucomaines, and microbes has been carefully studied by Professor Peter, who says in substance that in the consideration of these bodies we naturally turn to their chemical side. Here clinical experience steps in and shows that the difference in their poisonous properties corresponds to a difference in heat; poisoning by the extractive matters produces increase in temperature, while intoxication by the animal alkaloids produces decrease in temperature; and one may see in the same organism an association or alternance of the different poisons. But what is very interesting and of no little importance, says M. Peter, is that the discoveries of Gauthier really explain the formation of the most poisonous alkaloids and the still more poisonous extractive matters. "They show that auto-infection, *spontaneous* infection of the living organism, of the organism by the alkaloids and extractive matters, which it produces in itself because it lives, is merely a question of quantity; in other words, the living organism may poison itself simply by the accumulation within itself of these substances made in itself."

According to the same author a fifth part of the combustion of the animal economy takes place at the expense of the tissues without oxygen playing any part in the process; in other words, that portion of the tissues, represented in the fifth part of combustion, is destroyed by the anerobic or putrid ferments. Most of these toxic alkaloids are easily oxidized; they enter into combination and disappear, or do so in part. In a normal condition; a very small proportion of muscular leucomaine is found in urine. But if the air that reaches the blood be diminished in quantity, or the proportion of hæmoglobin be diminished, as is the case in chloris or anæmia, or if substances be introduced into the blood which prevent the process of blood-making, substances of the character of leucomaines or ptomaines accumulate in the blood. M. Gauthier further states, that with these toxic alkaloids, there exist nitrogenous substances, not alkaloids, which are still more poisonous. The septic poison of Panum contains hardly any alkaloid. In a recent discussion at the Paris Academy of Medicine, on microbes, ptomaines, and leucomaines, M. Gauthier spoke in the following terms: "Evidently the microbean theory cannot explain all the phenomena that are difficult to interpret. As medical science has not reaped all the advantages it appears reasonable to expect, the theory of animal alkaloids will probably clear up many questions which have hitherto remained obscure." The microbe theory and M. Gauthier's concerning animal alkaloids are not rival theories, on the contrary, one may be considered as the complement of the other. The whole subject of ptomaines needs care-

ful and fuller study: for as yet these products have not been properly classified chemically, nor satisfactorily studied. It may require many years to come to a full knowledge on these subjects; but about all the definite conclusions yet arrived at are these:

The Ptomaines or *Ptoamines* found in exhumed corpses are volatile, toxic alkaloids requiring but small quantities to destroy animal life for they are as virulent as nicotine, or prussic acid and hence the air of old cemeteries is extremely poisonous although it may be destitute of microbes. Some on the contrary are inactive, and others actually counteract the effect of otherwise poisonous substances. A few have been isolated, as from the abdominal fluid in suppurative peritonitis, which has long been known to be violently poisonous, and in which Spica recently has discovered an oily, volatile ptoamine allied to conine in appearance and odor, in physiological action to curarine. There is also said to be a typhus fever ptoamine.

As a type of the leucomaines we may instance *adenine*, recently discovered by Kossel, in the pancreas and spleen. It exists in many animal tissues, and can be extracted from them by proper reagents. Further, it appears that it is derived in the cell from the nuclein—a body already known—since, under the influence of water and heat the nuclein produces adenine, phosphoric acid, and albumen. Adenine itself can be wholly transformed into hypoxanthin or sarcine, thus showing its near relation to the bodies we vaguely call nitrogenous metabolites. Adenine has been isolated by M. Morelle from the spleen. This organ was chosen by the advice of Prof. Gauthier, because of its undoubted purifying action on the blood, being the place where alkaloidal and similar noxious products of metabolism are retained. The physiological properties of this leucomaine were tested, and it was found to be a paralyzomotor, with a powerful action on the medulla oblongata. A small quantity injected under the skin of a guinea-pig appeared at first to produce nothing abnormal, with the exception of immobility, a refusal of food, and some swelling near the point of injection for the first forty hours; but by degrees the depression and suffocation increased, and the animal died asphyxiated. At the necropsy were found congestion of the lungs with sub-pleural ecchymosis, general œdematous infiltration of the liver, spleen, and kidneys, and a certain hardness of the ventricles, appearing to indicate the arrest of the heart in systole.

Further consideration of these substances must be reserved for the section on antiseptics, where their neutralization properly belongs. The present section already exceeds the limits originally assigned it and must be brought as speedily as possible to a close, although there still remain other intermediate products of decomposition not yet described. Many of these arise from the putrefaction of unimportant constituents of the

body as for instance the bile acids, urinary sediments, etc.; and the whole subject may be conveniently closed by the use of the accompanying table, which shows at a glance the products ordinarily resulting from the decomposition of all the more important organic proximate principles of the body. The small numbers in brackets indicate the pages on which a fuller description of these substances can be found and the use of *Italic type* denotes that the substance so printed is disagreeable in odor, or dangerous in its properties.

TABLE OF DECOMPOSITION PRODUCTS.

NAME.	SOURCE.	DECOMPOSITION PRODUCTS.
Benzoic acid (208).	Urine after fruits, etc.	Hippuric acid ($C_9H_9NO_3$).
Choleic acid (201).	Bile of man and carnivora.	Cholic acid ($C_{24}H_{40}O_5$), taurin ($C_9H_7NO_3S$).
Glycocholic acid (201)	Bile and blood.	Cholinic acid, glycoll and cholaic acids.
Hippuric acid (208).	Urine herbivorous animals and man.	Glycoll ($C_2H_5NO_2$), and benzoic acid ($C_7H_6O_2$).
Lactic acid (199).	Muscular plasma and gas- tric juice.	Dilactic acid ($C_6H_{10}O_5$). Lactide ($C_5H_4O_2$). Bu- tyric acid ($C_4H_8O_2$).
Palmitic acid (164).	Natural fats.	Acetic acid ($C_2H_4O_2$), bu- tyric acid ($C_4H_8O_2$), and other acids of the fatty and amido-fatty acid series.
Paralactic acid (176).	Muscular flesh.	Dilactic acid ($C_6H_{10}O_5$). by heat.
Syntonin (172).	Contractile tissues.	Leucin and tyrosin and other amido-fatty acids, <i>ammonia</i> , carbonic an- hydride and dextrin- like body.
Tyrosin (157).	Nails, flesh, fibrin, hair.	Carbon dioxide (CO_2) and water and ammonia (NH_3).
Urea (206).	Urine.	By hydration to CO_2 and ammonium carbonate Am_2CO_3 .
Xanthin (201).	Urinary calculus, pancreas, liver, etc.	Hypoxanthin, guanine.
Glycero-phosphoric acid.	From lecithin from brain, etc.	Glycerin ($C_3H_8O_3$); phos- phoric acid (PO_4H_3).
Peptone (181).	Albuminoids by gastric fluid.	See albumen.
Amyloid.	Brain, membrane; walls of blood vessels.	With HCl, syntonin. ($C_3H_7NO_2$.)
Lecithin (182).	Spermatic fluid, blood, brain, etc.	Cholin ($C_5H_{15}NO_2$); gly- cophosphoric acid ($C_3H_5PO_5$).

NAME.	SOURCE.	DECOMPOSITION PRODUCTS.
Glucose (166).	Liver, bile, heart, etc.	$\left\{ \begin{array}{l} \text{Lactic acid } (C_3H_5O_3). \\ \text{Butyric acid } (C_4H_7O_2). \end{array} \right.$
Inosite (174).	Liquid of muscular tissue, etc.	Lactic acid ($C_3H_5O_3$); butyric acid ($C_4H_7O_2$).
Keratin (156).	Nails and skin.	Tyrosin ($C_9H_{16}NO_3$). Leucin $C_6H_{13}NO_2$.
Creatin (172).	Muscular tissue.	Sarcosin ($C_3H_7NO_2$); Creatinin ($C^4H_7N^3O$), <i>ammonia</i> .
Creatinin (173).	Creatin.	Sarcosin ($C_3H_7NO_2$), etc.
Leucin (157).	Nails, internal organs.	<i>Amylamine</i> ($C_5H_{11}NH_{21}$), and carbon anhydride (CO_2).
Nuclein (269).	Spleen and cell tissue.	<i>Adenine</i> . (See Leucomaines.)
Sodic glycocholate (200).	Bile.	Cholinic acid, glycoll and cholaic acid.
Sodic taurocholate (200).	Bile.	Taurin. ($C_2H_7NSO_3$), and cholaic acid.
Olein (164).	Fats of the body.	Glycerine (C_3H_5) (OH) ₃ , and <i>fatty acids</i> .
Palmatin (164).	" "	" "
Pancreatin (200).	Pancreatic juice.	See albuminoid ferments.
Pepsin (199).	Gastric juice.	" "
Stearin (164).	Fats.	Glycerine and <i>fatty acids</i> , or oxalic acid and carbonic dioxide (OC_2).
Paraglobulin (170).	Blood, serum.	See albumen. See fibrine.
Cerebrin (182).	Brain tissue.	Saccharine substance and other products.
Chondrogen (165).	Cartilage.	With H_2SO_4 yields leucin ($C_6H_{13}NO_2$).
Dyslysin (203).	Bile.	<i>Excretin</i> and stercorin.(?)
Elasticin (162).	Connective tissue.	$\left\{ \begin{array}{l} \text{Leucin and Glycoll} \\ \text{ } (C_2H_5NO_2), \text{ and tyrosin} \\ \text{ } \text{(by hydration) amido-} \\ \text{ } \text{fatty acids, } H_2S \text{ and} \\ \text{ } CO_2 \end{array} \right.$
Fibrin (180)	" " and muscles.	
Globulin (179).	Crystalline lens.	See albumen.
Glycogen (175).	Liver, blood corpuscles,	Glucose ($C_6H_{12}O_6$), etc., or oxalic acid ($C_2H_2O_4$) and water (H_2O).
Hæmoglobin (188)	Blood corpuscles.	Reduced hæmoglobin, hæmatin, methæmoglobin, etc.
Taurocholic acid (201).	Bile of man and carnivora.	Cholic acid ($C_{24}H_{40}O_5$) and Taurin ($C_2H_7NO_3S$).

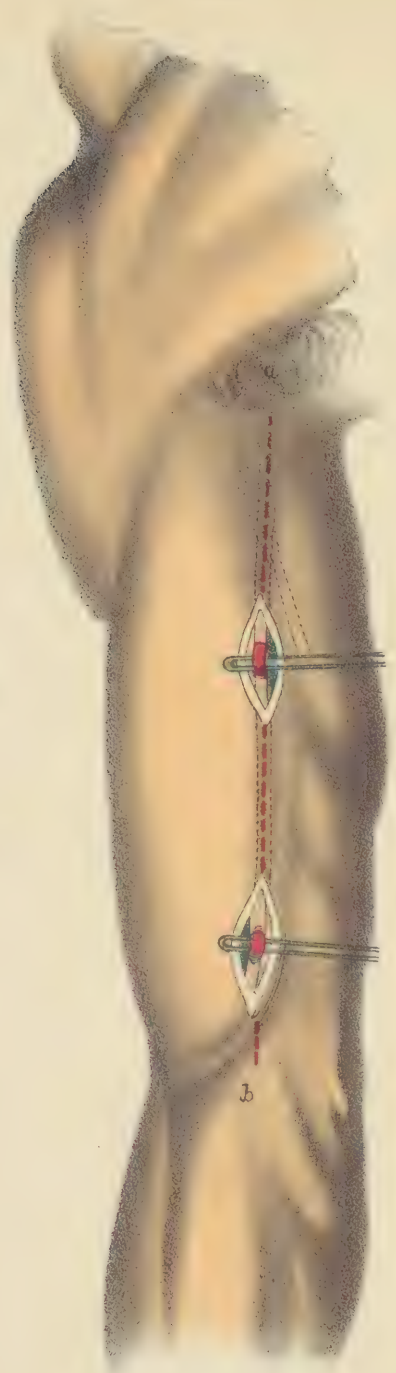
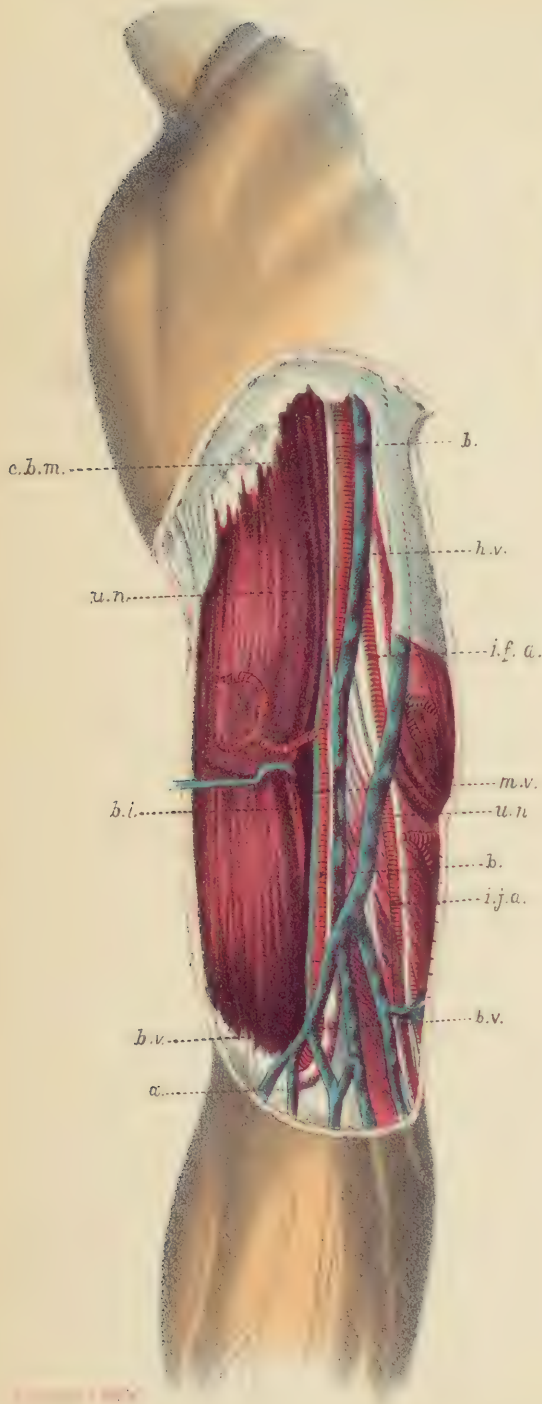
NAME.	SOURCE.	DECOMPOSITION PRODUCTS.
Uric acid (207).	Urine.	<i>Hydrocyanic acid</i> (HCN). <i>Oxalic acid</i> ($\text{H}_2\text{C}_2\text{O}_4$). <i>Cyanic acid</i> (CNOH). <i>Urea</i> ($\text{CH}_4\text{N}_2\text{O}$), etc.
Albumen (178).	Blood serum and urine.	Leucin, tyrosin, <i>ammonia</i> , <i>ammonia sulphide</i> , <i>Sulphuretted hydrogen</i> , <i>amido-fatty</i> and <i>aspartic</i> and <i>glutamic acids</i>
Allantoin (209).	Urine.	<i>Oxalic acid</i> $\text{C}_2\text{H}_2\text{O}_4$. and <i>urea</i> , CHN_2O .
Alloxantin (209).	Uric acid.	Alloxan (See below).
Alloxan (209).	Urine in heart disease.	Parabanic acid ($\text{C}_3\text{H}_2\text{N}_2\text{O}_3$). alloxatin (See above and CO_2 , <i>oxalic acid</i> $\text{H}_2\text{C}_2\text{O}_4$, <i>urea</i> $\text{CH}_4\text{N}_2\text{O}$, and carbonic acid.
Biliprasin (201).	Gall-stones and icteric urine. Bile and biliary calculi, “ “ “	Pigments are among the most stable of the con- stituents of the body (Richardson).
Bilihumin (201).		
Bilirubin (201).		
Bilifuscin (201).		
Biliverdin (201).		
Casein (180).	Milk.	Biliprasin (See above). <i>Carbon monoxide</i> (CO) and other products, with KOH gives <i>valeric acid</i> ($\text{C}_5\text{H}_{10}\text{O}_2$) and <i>butyric</i> <i>acid</i> ($\text{C}_4\text{H}_8\text{O}_2$).
Gluten and Pseudo Gluten.	Cartilage and bone.	See chondrogen and os- sein.
Succinic acid (202).	Fluids of spleen, etc.	<i>Acetic acid</i> ($\text{C}_2\text{H}_4\text{O}_2$), <i>val- erianic acid</i> ($\text{C}_5\text{H}_{10}\text{O}_2$).
Indican (102).	Urine.	<i>Glycicoll</i> ($\text{C}_2\text{H}_5\text{NO}_2$); ben- zoic acid ($\text{C}_7\text{H}_6\text{O}_2$).
Mucin (160).	Mucus, saliva, etc.	See bacterial fermentation,
Ossein (167).	Bony tissues.	Gelatin, collagen, glyci- coll, etc. <i>Ammonia</i> . (NH_3), Leucin (C_6H_{11} ; NO_2).
Myosin (172).	Muscle plasma.	<i>Formic acid</i> (CH_2O_2): <i>acetic acid</i> , ($\text{C}_2\text{H}_4\text{O}_2$); <i>butyric acid</i> , ($\text{C}_4\text{H}_8\text{O}_2$).
Indol(203).	Feces.	<i>Excretin</i> , ($\text{C}_{78}\text{H}_{156}\text{O}_8\text{S}$); dis- lysin ($\text{C}_{24}\text{H}_{156}\text{O}_3$).

This concludes our review of the decomposition products of the proximate principles of the human body. The preceding list does not include all those that have been given by other writers, nor indeed all

PLATE V.

I.

II.



of those previously mentioned in this book, but those only whose existence is well proven, and concerning whose decomposition something definite is known. The problem presented to the embalmer, is then, what means may be employed to prevent these decompositions, or if they have already occurred how they may at once be arrested and the disagreeable compounds neutralized. It is not the simple problem that the perambulating teacher of embalming would have you believe, but one of the most complex questions of applied chemistry; for each of its eighty odd factors needs separate and especial study, and the neglect of any of these may bring failure and disappointment for the rest. With all the aids of modern chemistry it is fighting against nature, and the wonder is not that embalmers so often fail, but that they have attained the success that as a rule they achieve when they intelligently adapt their means to the desired ends. How this may be best done will be discussed in the following section, which will be devoted to modern embalming and its methods.

PLATE V.

Figure II. illustrates line of incision for injection by means of the brachial artery. This can be most conveniently opened in the line running from the central point of the arm-pit (*a*) to the central point in front of the elbow joint (*b*).

EXPLANATION OF FIGURE I.

- b, b.* Brachial artery.
- c. b. m.* Coraco-brachial's muscle.
- bi.* Edge of biceps pulled back by hook to show vessels.
- a.* Aponeurosis of biceps muscle which lies between the brachial artery and medium basilic vein.
- b. v.* Basilic vein.
- m. c.* Median nerve inclosed in common sheath with brachial artery.
- h. v.* Humeral vein.
- i. j. a.* Inferior profunda artery.
- u. n.* Ulnar nerve.

SECTION V.

MODERN EMBALMING AND ITS METHODS.

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MODERN EMBALMING AND ITS METHODS.

THREE widely different methods for the preservation of the dead have been attempted in modern times. The first of these is the employment of cold, usually in the form of ice; for it is well known that with a low enough temperature putrefaction is impossible (page 231), but the ice box is cumbersome, expensive, and in warm weather, when most needed, is unsatisfactory in its results.

The second method attempted is that of hermetically sealing from the air the body which it is desired to preserve. If done thoroughly, that is, in calcined air, immediately after death, a corpse may be kept for a long time without decomposition; but this requires complicated and expensive apparatus and must be done before bacterial fermentation sets in, for we have learned elsewhere that where this once begins, it can be carried on without the aid of the air.

The third, which is preëminently the modern method, is to apply to all parts of the body such liquids or gases as shall prevent putrefaction, and neutralize its disagreeable products if already formed. This means, according to the modern theories of putrefaction, that this fluid or gas shall be antiseptic; that is, of such a nature as shall destroy bacterial germs, and, furthermore, disinfect, or be able to neutralize the products of putrefaction. Whatever agent is used must be able to penetrate all parts of the body: for if any portion of the body that has been accessible to the atmosphere is not reached by the germ-destroying substance, that part will form a center for germ development, with all the characteristic effects of putrefaction permeating the tissues from this point and rapidly spreading and destroying the body. Maceration, saturation with gas and arterial injections have all been employed in embalming; but up to the present time the first two have been so inefficient as compared with the third, that modern embalming now relies exclusively upon arterial injections to accomplish its results. The purpose of the present section, then, is not to debate whether it is desirable to employ arterial injections, but to indicate how these may be most satisfactorily used; leaving to each the choice of his own preservative fluid, after learning what

has been employed elsewhere with good success. Further than this, the scientific embalmer ought to be able, not only to use skillfully the fluids prepared by others, but to manufacture his own, and modify them according to the exigencies of the case; for no possible combination of antiseptics can meet equally well the requirements of every case that falls into his hands, for no two of these will ever be found exactly alike. Each case ought to be studied by itself and the preservative used adopted in accordance to the needs of the case, for this and nothing less constitutes scientific embalming.

Having fully studied the case, learned the cause of death and the present condition of the body, the embalmer may then prepare his fluid; and having, as we suppose, done so we shall endeavor in the present section to give the plainest possible directions for its best use, and the best methods for avoiding the annoying failures that otherwise will be sure to occur.

POINTS FOR INJECTION.

Since the *arteries* are open tubes, a fluid injected into any one of them will reach every part of the body. We find, however, that we can best use for arterial injection one of three arteries: the femoral in the thigh, the brachial in the arm, or the carotid in the neck. Let us first consider the *femoral*, as it comes out of the abdomen to the thigh in front, *midway between the center of the body and the prominent bony projection of the flank. A line drawn from that point to the most prominent bony point of the inner side of the knee will lie over the course of the artery*, where we wish to expose it. We find the artery, for its first three inches, covered only by skin and varying amounts of fat. A vein lies near it, to the inner side and slightly under it. We find a nerve on the outer side of the artery, slightly separated from it. Now, in cutting for this artery, it is important that one cut as near as possible to the abdomen, because the artery is there nearest the skin, and is larger there than at any point below. Some books say to inject below the point given, so that one may inject a vessel which is given off from the femoral about one and one-half inches below the abdomen, running downward toward the leg. The leg will receive enough fluid, if you inject as stated, by means of the connections of the vessels below and above.

Having cut for the artery, how shall we distinguish it from the vein and nerve? The artery lies between the vein and nerve—the vein on the inside. This will be more easily remembered if we take VAN (see plate III) to indicate vein, artery and nerve from within outward. All, or nearly all of the blood in a dead person is in the veins, consequently we find the arteries empty or containing but a very slight amount of blood, while a vein bleeds profusely when cut. The artery has thick walls,

feels like a thick tube and remains an open tube when cut across: the vein has thinner walls, feels like a single layer of tissue, and if cut across collapses, so that it does not appear as a tube. The nerve is easily distinguished from both artery and vein: it is white, is a solid cord and no cavity can be found within it.

The *brachial* artery is smaller than the femoral: it passes along the inner side of the arm. Its upper end lies midway between the prominent folds of the arm-pit and its lower end in front of the elbow, and exactly in the center (See plate V). A line drawn between these two points will lie over the course of the artery: it lies just under the skin and a varying amount of fat. Cut here, as for the femoral, as near as possible to the body, to get the artery where it is largest. Here we find the vein on the inner side: that is toward the body. Sometimes there are two veins, then they lie on either side of the artery. We find two large nerves (several small nerves are also near, but are too small to be mistaken for the artery): the ulnar nerve lies along the inner side of the artery, gradually receding from the artery as they pass down the arm together, and finally passing behind the inner part of the elbow: the median nerve lies on the outer side of the artery at the upper part of its course, crosses over it at the middle of the arm and lies on its inner side below. It is of about the same size as the artery, but will be recognized by having no cavity within it.

The *carotid* artery begins at the joint formed by the collar-bone and breast-bone, and runs upward on a line drawn to a point midway between the angle of the lower jaw and the bony prominence back of the ear (See plate IV). It divides into two branches opposite "Adam's apple." We must cut, therefore, on the line given below the level of "Adam's apple." Unlike the brachial and femoral, the carotid artery lies deeply covered by muscle, but is about the size of the femoral artery. The great muscle running from the head back of the ear, obliquely downward to the breast-bone, lies over it, and after cutting through the skin on the line given, it is best to find the inner edge of the muscle and pull it aside. We find the artery under the muscle with the deep jugular vein on its outer side. The nerve is a small one, behind the artery and vein, and between them.

In cutting for the arteries great care should be taken. The knife or scalpel should always be as clean and sharp as possible, so that it will make a clean, clear incision without much force. At the first, only cut through the skin and then with the fingers carefully dissect or tear apart the tissue in the direction of the artery as far as possible; and should it be desired to go deeper, use a large, dull pointed hook and with it raise up the tissue or fascia before cutting further, thereby being better able to accurately see just how far you are cutting. When near the arteries and veins, one should cut upwards or away from the vessels, lest by an

accident he might cut a vein and allow the blood to escape, which in some instances from the bleeding would be the cause of much annoyance. In operating, always avoid cutting any of the small veins which may be in the way, and which by a little care can be avoided. Plenty of time must be taken and perfection is attained through practice. The arteries which we use for embalming are always incased in a fibrous sheath, which should be carefully dissected away so that the arteries, veins and nerves can be separated easily. After finding and raising the artery, proceed to inject. Raise the artery above the incision, and pass a stick or something similar under it to hold it up; then with the scalpel or scissors make an opening lengthwise into it in its upper half about one-fourth of an inch long, and insert the nozzle of the syringe into it toward the heart, and then tie the artery firmly to the tube or nozzle. Again tie the artery back of the tube, so that the fluid in making its circuit can not escape, and proceed to inject. Before inserting the tube, however, the syringe should be used a little in the fluid, so as to expel air which would otherwise be driven into the arteries. Inject slowly and carefully, taking at least ten minutes for each quart of fluid. Should too great force be used in injecting, some of the arteries will be ruptured and their contents escape into the cavities, tissue or air-tubes of the lungs, and escape from the mouth or nose. After injecting sufficiently, the artery should be firmly tied above the tube so as to stop the escape of fluid when the syringe is removed, after which the incision should be filled with cotton, if necessary, to stop any leakage which might occur, and neatly sewed up. Now in making an injection, which is the best artery to use? The femoral is the easiest found and it is of practical size; the brachial is the smallest and not so easily found; the carotid is large but is found with difficulty, unless one has had a great deal of practice in cutting for it. If we inject from the femoral we drive a little more blood upward into the face. In some cases that may be considerable, but as a rule the arteries are empty, and then the femoral artery is certainly the best one to use. The pulmonary is the other system of vessels, besides the general system. The short pulmonary artery runs from the heart to the lungs, breaks up into minute branches (capillaries) and comes back to the heart as three or four short veins. This system is connected with the general system through the heart. Any injection, given as directed, will pass into the lungs or lesser system through the heart. If too great force be used in injecting, or an attempt be made to inject too much, one may rupture the small vessels (capillaries) in the lungs, and some of the fluid will escape, pass into the air-tubes (bronchial tubes) in the lungs, and escape at the mouth; this is a frequent cause of "purging" observed after injection.

If the upper limbs are well developed, says Richardson, inject the

brachial, if not, inject the femoral; and in either case, the right side will be more convenient. The brachial (See page 278), is exposed by an incision on the inner edge of the biceps muscle (the great muscle of the upper arm) about midway of the arm. It should be exposed for a full inch and a half, and in the line of the vessel (See plate V). It should be well lifted up from surrounding parts. An opening is made in the line of the vessel and the injecting tube inserted, pushing the point into the artery toward the heart for a full inch and a half. The artery should then be tied around the tube to retain it, and also below the tube to prevent loss of injecting liquid. The tube may also be tied to the arm by a tape. The chief objection to injection by the carotid (See page 278), is the depth at which it lies, and the danger of opening the jugular vein at the same time; for it must be remembered that the common carotid artery in the neck is inclosed in a fibrous sheath, which also contains the internal jugular vein lying to the outer side of the artery, as well as the pneumogastric nerve, which lies beneath and behind both; the sheath rests on the vertebral column. To the inner side of the carotid is the trachea and larynx; to its outer side, and inclosed in its sheath, the jugular vein. It may be inferred from the above, that the jugular vein in the neck is in close proximity with the carotid artery, and great care must be exercised in puncturing the artery not to injure the vein lying at the side.

Cavity embalming. In addition to arterial injection, we may aid in the preservation of the body by injecting the abdominal (peritoneal) cavity and the cavities in the chest (pleural cavities). The abdominal cavity extends from the ribs, above, to the hip bones, below, and on each side, nearly to the spine. In passing a trocar into this cavity, we choose the central line, near the navel, because the abdominal wall is thinnest in that point. If the instrument be pressed too far, there is danger of going beyond the cavity and piercing the intestines. To avoid that, pass the instrument inward until the end moves about freely; it is then in the peritoneal cavity, and injection may be continued until the cavity is full. The chest cavities, on each side, contain the lungs. On the left side, the heart (See pages 62-63) occupies a space inside of the left nipple. On the right, the liver extends upward to the sixth rib. To avoid the heart on the left side, and the liver on the right, it is best to introduce a trocar between the ribs just at the lower end of the shoulder blade on each side. If we pass the trocar too far, we pass beyond the cavity into the lining. When the end of the trocar moves freely about, it is in the pleural cavity, and we may proceed to inject. Too much fluid injected into the cavities may cause "purging" by pressure upon the lungs and stomach. If it be desired to withdraw dropsical fluid from the cavities introduce the trocar into the lower portions of the cavities, and turn the body so that the fluid may escape by gravity.

The cavities should be injected by using the trocar or hollow needle. The thoracic or lung cavities should first be injected. Each lung has its own cavity. On the right side, inject between the second and fourth ribs, so as to avoid the liver, and in the left side inject lower down so as to avoid the heart. The abdominal cavity can be injected anywhere below the diaphragm, that portion of the body being one entire cavity. When there is a failure in getting fluid into the stomach through the mouth or nose, the desired end may be gained by injecting into the stomach directly with the hollow needle. The largest and most accessible portion of the stomach lies on the left side of the body, just below the ribs and midway between the lower and central point of the sternum or breast bone, and the side of the body at an angle of about forty-five degrees downward. By inserting the needle at this point, it will penetrate the stomach (marked x¹ on plate I). Should this operation fail, an incision about three inches long could be made obliquely over the stomach at the point already given, and by the use of a hook and the fingers, the stomach can be raised, since, at this point, it rests upon the walls of the abdomen; after having raised it, it can be injected with the hollow needle, or an opening made into it large enough to pour fluid from a bottle into it, after which the incision should be neatly closed. Should it be desired to fill the bronchial tubes of the lungs and not possible to do so from the mouth, the hollow needle can be used to advantage by inserting it into the trachea or wind pipe, just above the collar bone.

When using the hollow needle, care should be taken to see that it is perfectly clean, both outside and inside, so that it will penetrate the tissues easily and the flow of the fluid may not be obstructed. When inserting it into the body, if you are unable to get fluid into it, keep drawing the needle outward until the fluid flows freely through it: at first its point may have been driven into solid tissue, thus preventing the ready flow of the fluid. The cavities should not be over-filled, but moderately full. After injecting, the syringe should be removed from the hollow needle to allow the escape of gases. The escape of fluid from the cavities after removing the hollow needle often causes trouble, and several methods have been devised to prevent this. The simplest and best way is to use a small, sharply-pointed peg of soft wood; after removing the hollow needle, insert the peg in the opening made by the needle, and, with a pair of small cutting nippers, cut it off even with the skin, and then draw the skin over it, which will hide all traces of the instrument, and is the most effective device yet suggested for this purpose.

The preceding method, prepared by one of the most successful embalmers in this country, is essentially that adopted by all modern embalmers. Wherein their methods vary in minor details, we shall endeavor to show: but arterial embalming is the process employed by

them all, though their solutions vary greatly. Some advise the use of the hollow needle, instead of the tube of the syringe, for injection into one of the larger arteries of solutions of various kinds. One of the very simplest and best of these methods is what is known as the

LOWELL PROCESS.

A solution of chloride of zinc is the preservative fluid used; this is contained in a porcelain-lined vessel, which is elevated to a convenient height, so that the contents will be injected into the cadaver after the manner of a gravity-syringe. For the passage of the fluid from its receptacle into a vein of the cadaver, glass and rubber tubing are all that is required. A finely-tapered glass tube is held tightly in place in the vein, while a glass U-shaped tube acts as a siphon to conduct fluid from the receptacle. The quantity of fluid will, of necessity, vary in different cases; four or five gallons may be required. This plan will not work when operations have been performed whereby large vessels have been opened. Bodies thus treated have been transported long distances, without odor, and without disfigurement or any external signs of decay. All that is required is that the physician should expose a vessel, adjust the glass tube, and the fluid will find its own way. Dr. Lowell has let the instrument run all night. Dr. Lowell writes: "The injection may be made by either artery or vein. I have tried both with success. I prefer the brachial artery above the elbow as the point for introduction of the glass tube, for the primary incision is slighter, and consequently divides smaller and fewer veins than when I expose the femoral artery. I use the gravity method, and introduce about five gallons of the antiseptic fluid. The effects are eminently satisfactory. The color of the integument is improved, even at points where hypostasis has been at work. I inspected a cadaver night before last—a lady. The body was in splendid condition—skin white and clear, and all points of discoloration along spine, nates, posterior surface of thighs, neck, etc., clearing up. The patient died of typhoid fever: post-mortem discoloration rapidly supervened, and decomposition was rife. All changes were arrested, the skin cleared up, and when I saw the body last its appearance had improved wonderfully."

RICHARDSON'S PROCESS.

Remove all the clothing from the body, cover it with a loose cloth or sheet, lay it on its back on a table about seven feet long, two feet six inches wide and high; a smaller table, a foot or two higher, is desirable for the embalming solution.

If the stiffness has not passed off, the limbs should be gently flexed and extended until relaxation takes place. If it is convenient to lay the

body first in a warm bath for sometime, the injected fluid will flow more readily. The temperature of the bath should not be above 140° F., otherwise the muscles and vessels will become rigid, the principal vessels be contracted, and the injection obstructed.

Richardson, as a preliminary step, injects the vapor of ammonia, by drawing air into a bellows from the neck of a bottle containing a strong solution of ammonia, and injecting the artery through the long rubber tube, this is to diminish the resistance of the vessels.

A bottle containing the antiseptic, zinc solution (F 64) having been raised above the level of the body, and by the gentle action of the bellows (See apparatus) caused to flow easily and rapidly into the blood vessels, the quantity injected being measured with precision.

By the action of a hand-bellows the liquid is slowly and gently pressed into the artery. It is better if it run of its own weight for the best injections are where the least force is used; if the bellows is used, and the vessels are filling properly, we can detect with each stroke of the bellows a pulse-like sensation in the large arteries near the surface.

After one or one and a half pints have been injected, it is well to make a few punctures in the tips of the fingers and toes, through which a little of the injection may escape. The appearance of the liquid at these openings will show that the tissues are being filled, and will also prevent the rupture of vessels into the cavities. The loss of an ounce or two of the liquid will make no difference in the success of the embalming.

After four or five pints are injected, mottling of the skin appears on the face and soon extends over the body. These spots are about the size of a split pea and hard; they disappear after a time, and indicate that the injection is nearly complete; about one pint more may be slowly injected.

The first injection will require about two hours; an interval of six to twelve hours follows to allow perfect diffusion of the liquid.

It is well to allow the apparatus to remain in place and additional liquid to enter the body by its own pressure.

At the end of the interval, if the operation is successful, the body will be white and very hard, muscles rigid and limbs fixed, while the facial expression will probably be lifelike, and a cast of the face may be taken. Failure of injection may occur from rupture of vessels into cavities; it may be necessary to repeat the injection. If the injection has been successful, the artery tube is disconnected from the rest of the apparatus, another piece of tubing is attached, and with a syringe four to six ounces of the silicate of soda injected. This, coming in contact with the chloride of zinc in the arteries, coagulates, and thus fills the vessels with a firm colloidal plug. The artery tube may now be removed, the vessel firmly tied and the opening in the skin neatly closed with silk sutures. This can be done so that scarcely a mark will remain.

The cavity of the abdomen will probably now be found distended with gas until a pointed hollow needle is introduced and the abdomen pressed upon until the gas escapes. It may be necessary to puncture the intestines, this may be done with a long bladed fine bistoury, the blade of which is introduced through the needle opening into the cavity and zinc colloid (F 65) should now be injected through the hollow needle. This coagulates the mucous secretions, intestinal fiber and membrane. The needle opening is then closed with a stitch; the same should also be injected into each side of the thorax between the third and fourth ribs, and a few ounces into the cavity of the skull. To do this a long fine hollow needle shaped like a probe is forced into the cavity of the skull through that of the nose; there is very little resistance; the colloid is now injected until a little resistance is felt. The needle is now withdrawn, for the injection would otherwise make posterior pressure on the eyeballs, and push them forward.

WYVODZOFF'S PROCESS.

The common carotid, brachial and femoral arteries on both sides are cut down upon, and their accompanying veins exposed to view, a longitudinal slit, about half an inch in length, is made into the carotid and brachial arteries and jugular and brachial veins. The four canulæ of his apparatus (See page 292) are inserted into the arteries and two ligatures placed on each, and fastened in the grooves of the canulæ. These retain the canulæ in position and also prevent regurgitation. The connections of the apparatus are made, the liquid is pressed into the tubes, and as soon as these are filled, connection is made with the canulæ. The liquid passes both upwards and downwards through the arteries. When the body begins to swell and the face to get puffy, particularly under the eyelids, the canulæ should be withdrawn, and arteries tied at both openings.

The femorals are now similarly injected, until the liquid itself escapes from the open veins. The veins are now tied, and injection continued until clear liquid begins to flow from the nostrils. The femoral arteries are now tied, and the wounds sewn up. Toward the close of the operation the abdomen swells up, face and chest become rounded and eyelids puffy, skin whiter, more opaque, feeling like parchment. After a few days the features resume their natural size, but the parchment condition of the skin continues. After three or six months the body begins to shrivel; after six to twelve months the skin gets darker (sometimes brown), and the body mummifies, the muscles remaining soft and flexible. It may last thus for any number of years. The operation will take from one to six hours, if the body is fresh, the materials all ready, and sufficient apparatus is at hand to inject the carotids,

brachials and femorals, at the same time. If the operator is skillful in reaching and opening the vessels, and if he has an expert assistant, the whole operation may be finished in an hour. For fluid, used see formula 12.

CAVITY EMBALMING.

Instead of arterial injection many embalmers still employ the less efficient process of injecting the cavities of the body as a substitute for the better method. As there may be times where the latter can not be used we give full directions for cavity embalming in the words of one of its best exponents :

“ The first step to be taken upon arrival at the chamber of death, is to create a current of fresh air by lowering the upper part of a window, or a couple of them if there is no transom-light over the door. Next, remove the body from the bed and place it on a cooling board ; this board ought to be elevated about one foot at the head ; also, the body should be raised at an angle of about forty-five degrees ; this disposition of the body will allow the fluids contained in the circulatory system to go down of their own gravitation, and leave the face, neck, and upper part of the body uncongested, and therefore free from the purple spots that gradually discolor the face and neck.

“ The mouth must then be firmly closed by means of a ligature tied tightly around the head and passed under the apex of the chin ; this ligature should be kept in place until the rigor mortis has firmly set the jaws together.

“ The eyes must next be attended to : the lids must be brought together firmly, avoiding at the same time interference of the lashes, or the creation of wrinkles of the skin on the corners, using pads not larger than a quarter of a dollar, soaked in some antiseptic solution, such as corrosive sublimate (See formula 30), which should be used with caution and kept protected from the light.

“ The face and body should be washed all over with tepid water and soap, and perfectly dried with towels. Make a diaper out of cloth, fasten the same firmly around the loins, and pin the same well in front. The face should be well moistened with an antiseptic solution, and a double cloth laid carefully and evenly over the features, so as to come in direct contact with every part of the same. This cloth must be kept moist with the solution, and remain there until such time as the body is placed in the coffin. Fold neatly some small pieces of cotton, saturate them well with solution, and cover over the chest and abdomen.

The next step to be taken, consists in preventing frothing or purging from the mouth and nostrils ; also, keeping down generation of gases, and swelling of the stomach and bowels.

Make an incision about four or five inches in length in the abdomen,

above the traverse arch of the colon; this incision will reveal the colon and upper part of the large intestines, also the stomach a little to the left; the colon and some of the smaller intestines are punctured, and after expelling the gases and air by firmly pressing on the abdomen, are injected with about eight ounces of the solution. (See formula 22.) The bowels being injected, the stomach is emptied of its contents by puncturing its walls and by pressing gently upon its outer surface in a downward direction; the matter contained in it will be forced out into the abdominal cavity, and can then be either sponged or scooped out; the stomach is then injected in a similar manner as the bowels; some of the solution is then poured between the interstices of the bowels, and some cotton batting laid evenly over the bowels, the cotton well saturated with the same solution; the lips of the wound are then brought together and neatly sewed up. It will be readily understood by the above described operation that no gases can be generated in either the bowels or the stomach, as the injecting fluid in those parts of the viscera will effectually prevent their formation; and this being the case, the purging at the mouth and nostrils, which is the result of the escape of gas driving out the contents of the stomach, is avoided. The expansion of the abdominal viscera, or the bowels, is also prevented by the same cause.

It will be understood that this process cannot be successfully applied where the corpse is that of a person who has died of some contagious or infectious disease. And it should always be remembered that at best cavity embalming is but a poor substitute for arterial injection, even though the hollow needle (See page 291) is used, which simplifies the process so that it can be performed by anyone; and yet even with this most useful instrument it is impossible to as thoroughly permeate the tissues as by arterial injection.

In using the hollow needle, the body is laid on a cooling board, and, all preliminary details having been attended to as before, the needle is inserted in the abdomen at or near the umbilicus; the point is directed toward and into the stomach; a gentle pressure with the hand over this organ will cause its gaseous and liquid contents to escape through the needle. This done, the instrument is drawn back about half its length, and brought down vertically almost in a straight line with the middle of the sternum, so as to perforate the traverse part of the colon, or large intestine. The gas or any liquid then contained in that part of the viscera, will thus find an outlet. This same operation may be repeated for the other parts of the abdomen containing the small intestines, and the needle may then be withdrawn. As to the gases or liquids which may have accumulated between the intestines and the walls of the abdomen, they will escape through the needle, or the small aperture caused by it. To assist in thus expelling morbid products, whether gaseous or fluid,

the hand may be applied to the different parts which the needle is supposed to have perforated, pressing gently, and in such a way as to direct the escape to the outlet left by the needle. It is not expected that the solid contents of the stomach, or the feces contained in the bowels, can be got rid of through the agency of the needle, but we consider that the properties of the fluid thereafter injected into and around these organs will arrest the putrid tendencies of those substances.

This part of the operation having been satisfactorily performed, inject through the nostrils, by means of the flexible tube, as much of the fluid as the chest will contain. This part of the process can be performed in a more complete manner by artificially reproducing the movements of respiration, while the injection is taking place through the nostrils. When the quantity thus injected has filled the trachea, further injection must be suspended, and the nostrils filled with cotton.

The cavity of the chest surrounding the lungs, and the lungs themselves, can be injected by forcing the needle under the lower part of the sternum and injecting by turns the right and left sides of the body. To inject the fluid into the abdomen and stomach, the handling of the needle is the same as above given for the expulsion of gases, and inject through the needle from the same perforation made. *Before puncturing the body with the hollow needle, stretch the skin to one side, so as to cover the opening made in the flesh after the needle is withdrawn.*

The use of the needle does away with the knife, leaves a barely perceptible trace behind, no gaping wound, suture, or, in fact, any of the usual marks of a surgical operation, which will at all times impress the bystander in a more or less unpleasant manner, but its chief advantage lies in the fact, that the body need not be in a state of nudity to successfully apply the process; a small rent in the clothing, or a rent in the dress, however diminutive, will be sufficient for practical purposes. However, when the remains of a person are to be thoroughly embalmed, arterial injection should always precede that of the needle, for the good reason that the introduction of the needle into the abdomen or the chest is always attended with some danger to the integrity of the circulating system. The point of the needle may so wound or lacerate the walls of the numerous arteries inclosed in the thorax and abdomen, that, should a subsequent injection of the arteries be performed, the course of the liquid would terminate at this point, and overflow into the surrounding tissues or cavity.

QUANTITY OF FLUID REQUIRED.

The amount to be used depends altogether upon the size and condition of the body. The arteries of a large muscular person, or of a person who, during life, pursued some kind of manual labor, will be found quite

large, and very easy to find and inject, and will take fluid quite readily. The arteries of men who are unaccustomed to hard work, and those of females generally, are quite small considering the size of the body, and are not so easily found and will take less fluid. There is no rule to go by in estimating the quantity of fluid necessary to inject the body. The best way is to inject carefully, no matter which artery used, until they stand out quite prominently on each side of the bridge of the nose and on the forehead, then you should stop for a time at least. If a good penetrating fluid be used, the body will again, after the lapse a few hours, take nearly as much again. Wyvodzoff follows the rule that the quantity of injecting fluid used must be half the weight of the body.

Doctor Suequet used $4\frac{1}{2}$ quarts chloride of zinc solution; Renouard requires 5 pints for a full-grown person. Howse, as described elsewhere, uses $1\frac{1}{2}$ quarts arseniated glycerine, followed by glycerine alone until two gallons have been used in all. Richardson employs a pint or a pint and a half of strong zinc solution, then punctures the toes and uses in all 5 or 6 pints with his zinc colloid (See formula 65); of the latter 6 oz. for the abdomen, 4 oz. for each side of the thorax and 1 to 2 oz. for the cranium. Lecanu used seven litres (about 11 pints) of his solution.

TIME REQUIRED FOR INJECTION.

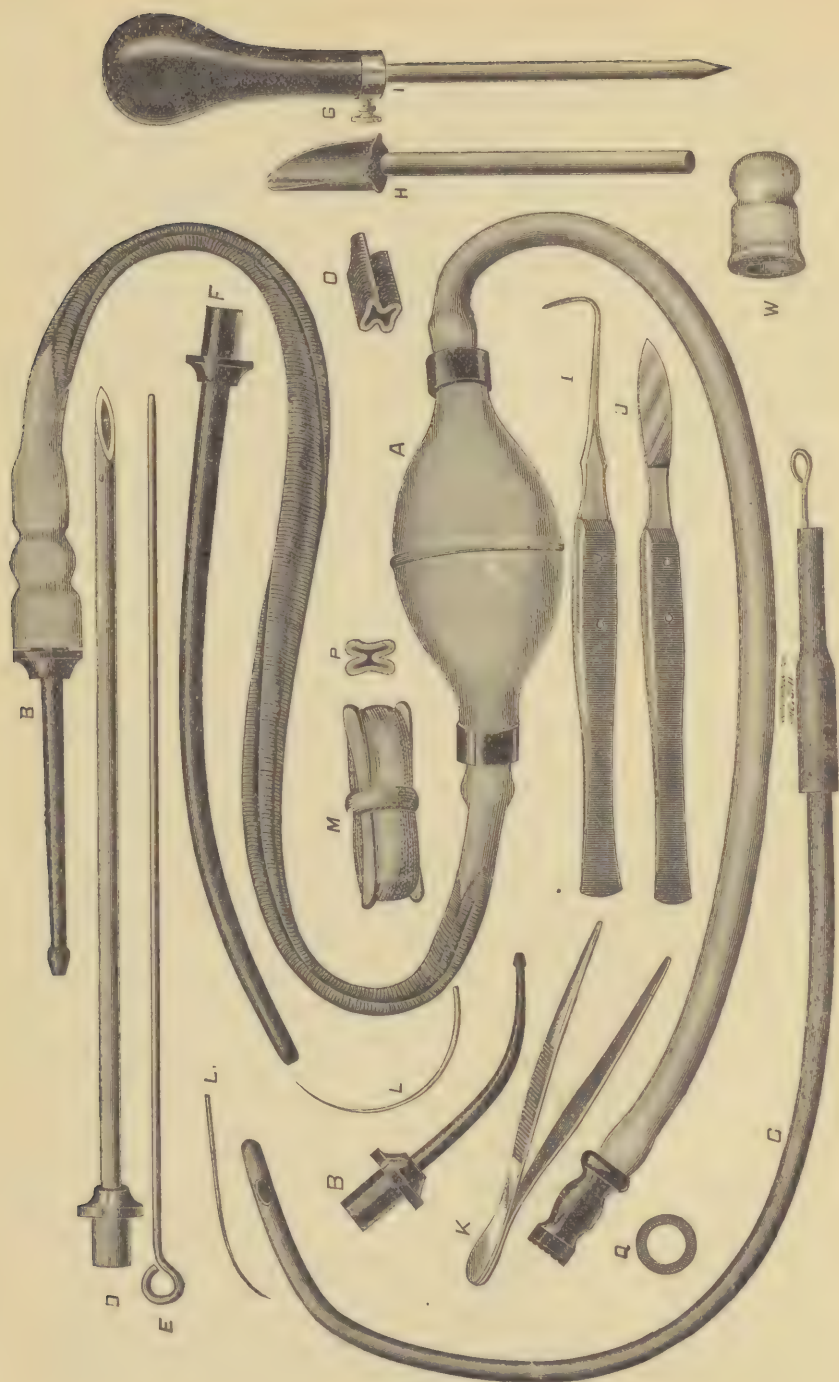
It is a fact worthy of notice, that the injection of the arterial system should be conducted in a very slow and methodical manner, and the whole amount of fluid necessary for the preservation of the body ought never to be introduced at once, but in small quantities and at intervals varying in length according to the nature of the case and size of the person.

At least ten minutes should be taken for each quart used. Richardson (page 280) allows two hours for injection of chloride of zinc and an interval of from 6 to 12 hours before the introduction of the silicate solution. Wyvodzoff's process requires from one to six hours. Renouard says very justly of arterial injection, on this subject, the principal art required in this process is to be very careful not to use too much force in driving the fluid into the tissues, and not to use too much fluid. The fluid can be injected quite cold, and will find its way.

APPARATUS REQUIRED FOR EMBALMING.

The following cuts illustrate the instruments required by the embalmer in the performance of his duties. The syringe illustrated is from a photograph of a newly-invented instrument.

The principal feature of this ingenious improvement consists in a simple change in the formation of the rubber outlet tube, which completely changes the action from an intermittent to a steady continuous flow. The flexible tube is made of very fine rubber, vulcanized in a cor-



rugated or inwardly folded form (as shown in cross-section at O and P), so as to contract its capacity and allow expansion; and when expanded from internal pressure it is simply a flexible tube, slightly larger than those usually made (as shown in cross-section Q), with an elastic tendency to contract into its dormant corrugated form, with the walls in close proximity on their inner surfaces (See P).

When the bulb is lightly compressed, in the usual manner, the liquid flows into and expands this flexible tube into a temporary reservoir, and the elastic tendency of the rubber to regain its dormant folded shape creates an automatic pressure, assists the action of the syringe, and keeps up the flow, while the bulb is expanding and refilling.

The socket or extreme end of flexible tube is made from pure soft rubber, and the instruments B, D and F are of hard rubber, and are attached to this socket by simply being forced into the soft rubber socket, without threads, as in the common syringes; thereby making a perfect air-tight joint, thus doing away with leaking and soiling of linen with embalming fluids, so common with other kinds of pumps and syringes. The canulæ B are used to inject fluid into the arteries. The one in the center of cut being small enough to be used in injecting the carotid arteries of a newly-born infant. The catheter C, by means of the soft rubber pipe on its end, is attached to canula B by simply being forced on it; the expanding of the pipe making a perfect joint; it is used in injecting fluid into the stomach through the mouth or nose, and is often used with advantage in connection with an aspirator by raising the internal jugular vein, and running it downward to the heart, in order to remove the blood from the body.

Before attempting to use this instrument, it should be placed in warm water, thus making it more flexible. F is also used like the catheter, but is attached to the soft rubber socket directly. The trocar G is used in connection with the socket H; in using this instrument, the point of G is inserted into tube H, and is used in removing water from the abdomen of dropsical subjects by inserting it into the most dependent portions of the cavity; while in that position, remove instrument G, and the fluids will pass out through the tube H, and after all of the fluids have been withdrawn, remove tube H, and close up the opening either by a ligature, cotton, or by using a sharply-pointed soft wooden peg.

Aneurism needle I is used in making incisions and raising arteries; its point should have a neat round edge. After cutting through the outer tissues, this instrument is used to assist the fingers in tearing apart the tissues and separating the arteries from the nerves, veins and sheaths in which they are incased. The eye in the needle is used in assisting to pass a string under the arteries. Scalpel J is used in

making incisions, and should always be kept perfectly sharp, with a keen cutting edge. Forceps K is used for various purposes, but more particularly in assisting in raising arteries. L are surgeon's needles. The circular needle is used in sewing up the lips when required. The operation is performed by passing a fine thread on the inner side of the lips near the gums. The straight needle is used in sewing up incisions after a post-mortem or in raising any of the arteries. M is thread used in sewing up incisions or tying the canulæ in the arteries. It has long been the belief among members of the profession that for this purpose nothing but silk could be used, which is incorrect. Silk, as a rule, is too sharp or cutting for this purpose, and at the same time too expensive. The best thread for this purpose being common saddlers' thread, which is cheap, smooth and strong, answering every purpose much better than silk. D is a hollow needle which is attached to the syringe, and is used in injecting the cavities of the body. The point of this instrument is supplied with several openings, thus affording an easy escape of fluid in case the point is closed, or one of these openings is in a cavity or some part requiring injection, while the point of the instrument was beyond it. E is simply a small rod used for clearing obstructions in tube D. W is a soft rubber cap to be used to close end of canula B when it is desired to let the canula remain in the artery for a second injection, thus doing away with the necessity of removing it and tying the artery, as is necessary with other styles of instruments.

One great advantage in using rubber instruments is that they require very little attention or cleaning. Should they be put away immediately after using without cleaning no harm will be done, as in the case of metal instruments. After using the metal instruments they should be well washed with soap-suds and well dried by heat before being put away.

There are cases where hydrostatic pressure is preferable to the pump or syringe in injecting a body arterially, as in the case of some of the arteries being ruptured in a body, as is not unfrequently the case in dropsies, pleurisies, tumors, and diseases of the respiratory organs, especially consumption, all of which will be fully discussed in their appropriate section.

In such cases the pressure from a syringe, no matter how even, would be too great, and as a usual result the fluid would escape from the nose or mouth, or into some of the cavities of the body, thus not accomplishing all that might be desired. After many experiments by the writer, it has been fully demonstrated that in such cases a perfect injection can be obtained by procuring a one gallon rubber bag with a hole in its bottom, or a large fountain syringe, attaching a rubber pipe to the bag, and at the other end of the tube a canula B, and inserting the canula into the artery. Hang the syringe or bag about six inches above the body to be

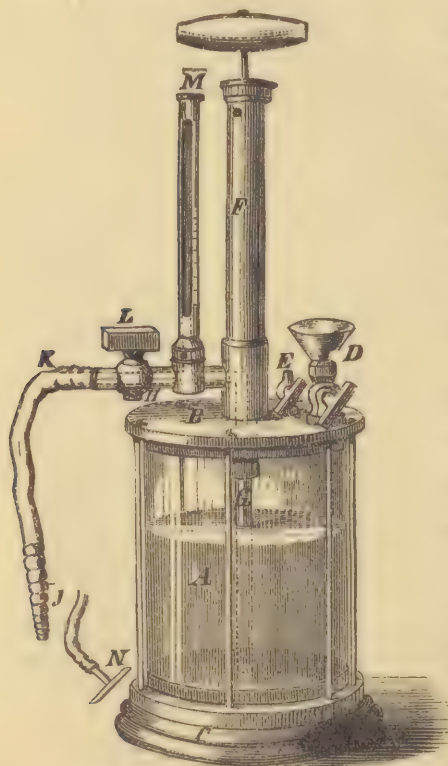
injected. Should it be found that the pressure is too great, lower it a little, and in this position let the fluid run until you are satisfied that enough has been used. In all cases where the fountain syringe can be used, it is preferable, for it is the only true way to inject the arteries properly. It is surprising how large an amount of a good, penetrating fluid the body will take up by this method. Before using any syringe, fluid should be first run through it so as to expel the air that otherwise would be forced into the arterial system.

There are other forms of apparatus, one of which is figured later. The ordinary Richardson apparatus consisting of a graduated bottle, which will hold six or more pints of liquid and which can be fitted like a Wolff's bottle with tubes. A short tube passing through the cork, has attached to it a double hand bellows; and to the long exit tube is connected a long rubber tube, to the other end of which is the artery tube. It is well to put the liquid in the bottle and attach the long tube before going to the place where the embalming is to be done; then the different steps of the operation can proceed without delay.

Dr. Richardson's bottle holds six pints of liquid, and is fitted into a basket in which it may be carried. The artery tube connects with the long rubber tube with the tap attached. By the action of the syringe or double bulb bellows attached to the other tube the liquid is pressed into the arteries.

Dr. Wywodzoff's apparatus consists of a glass jar, A, seventeen centim. in length, eleven centim. in diameter, having the capacity of four pounds (pints). This jar is hermetically closed by a brass cover, B, which is connected to a heavy brass stand, C, by six brass rods secured by nuts. Through the cover passes a glass funnel, D, with a stop-cock for passing the liquid into the jar.

A brass tube, E, with a cock, permits the exit of the air, when the fluid is poured into the jar; an air-pump, F, for the condens-



DR. WYWODZOFF'S APPARATUS.

ation of air, has a piston with a spiral spring. Through the barrel of the pump, besides the channel for the passage of the air, there is also a glass tube, *G*, which arises from the bottom of the glass jar, and is continuous with the channel of the cylinder, which is bent at a right angle, and connected to the horizontal tube *H*. The horizontal tube *H*, at its termination, affords an attachment to the rubber branch, *K*. The tube *H*, has also a stop-cock, *L*, for controlling the flow of the liquid, and a manometer, *M*, by which the pressure of the liquid is determined, and the flow regulated. The glass manometer is inclosed in a brass tube, which has divisions indicating the atmospheric pressure. The only part of the apparatus that remains to be described is the T-shaped canula *N*, which is designed for introduction into the artery, and to be connected with the rubber branch, *K*.

The apparatus is brought into action in the following manner. All the stop-cocks *D*, *E*, *L*, are opened, and the jar is filled with the anti-septic fluid through the funnel *D*, while the air escapes through the tube *E*. The cocks are then closed, and the air-pump used. Under the pressure of the air, the liquid rises in the tube *G*, and passes into the horizontal tube *H*. One part of the liquid passes into the manometer, and rises to one of the divisions, according to the amount of pressure exerted; the other part of the liquid (the cock *L*, being open) passes into the rubber branch, *K*, which at the time of injection is connected to the T-shaped canula, *N*.

It is evident from the above description, that the higher the liquid arises in the manometer the greater will be the force and volume of liquid ejected. The flow of the liquid can be increased or diminished at pleasure by turning the stop-cock *L*. But if it should be necessary to keep the column of the liquid in the manometer at a certain height, in order that the flow of the liquid may be regular, the pumps must be constantly used.

The addition of the hollow needle to the undertaker's list of instruments (See page 287), is a real acquisition. This little sharp-pointed steel tube, perforated at the extremity, affords alike a means of egress to the gases accumulated in the body, and also serves to introduce the preserving fluid into the thoracic and abdominal cavities. The needle, when dexterously used and skillfully handled, completely, and with advantage, replaces the knife in many places, *e. g.*,

1. The needle, when adroitly directed into the several organs, or parts of the viscera which are to be relieved from the gases therein accumulated, will effect the intended purpose thoroughly, and without leaving a wound of undue proportions.

2. It will reach deeply-set organs and cavities, which otherwise would necessitate extensive operations with the knife.

3. It reduces the process of preservation to a very simple operation which can be performed in a short time and without any further attention being required on the part of the operator. But if the advantages derived from a judicious manipulation of the needle will benefit the operator in the handling of the bodies, it also becomes equally inert and almost useless where the operator reveals his lack of familiarity with the different uses to which it can be adapted, and his ignorance of its most useful results.

Another apparatus not figured acts on the principle of the automatic syringe, the pressure on the surface of the fluid forcing the liquid up the long tube in the bottle and over the tube on the left-hand side. The left-hand tube terminates in a stop-cock, to which the needle to be inserted in the artery is joined. The tube leading to the bottle is India rubber, of an eighth of an inch bore, and may be several feet long. Before the arterial needle is tied in the artery, the stop-cock is turned off, so that no fluid may pass.

When the needle is fixed, the stop-cock is opened, and the bottle is raised on a table three feet above the level of the lower end of the injecting tube. As a rule, the fluid will now descend by its own weight, and gravitate all over the body; but if it fail to do this, additional pressure for a short time will be sufficient to carry on the current.

Mr. Howse recommends two tubes with stop-cocks and long nozzles for the artery, one directed upwards and the other downwards. He uses a rubber tube dipped into the reservoir of liquid, which is elevated above the level of the body, the other end of the tube being connected with the artery tube. This syphon must, of course be filled first, and as it takes a long time for the viscid glycerine to fill it, he fills it first with his arsenite of potash preservative.

Meanwhile the stop-cock of the artery tube is kept closed, until the tube is filled. The tube is then turned down into the reservoir, the stop-cock opened and the glycerine flows slowly in. Of the arsenical glycerine which he uses, a quart and a half will be enough to inject first, followed by glycerine alone.

It is necessary that the tube be kept full of the liquid, or bubbles getting in and being forced into the blood vessels will stop the injection.

The height of the reservoir above the body will vary with the viscosity of the liquid, from three to six feet.

The appearance of the arborescent veins over the surface of the body, shows that the injection is flowing satisfactory.

DIFFICULTIES, PRECAUTIONS AND PRACTICAL HINTS.

When upon injection, a body becomes black or of varying dark shades of color, it is due to the driving of the blood into the small ves-

sels (veins and arteries) of the skin. During injection the solution used passes into the arteries, and finally into the veins, displacing the blood and driving it to the surface of the body. It can be expelled by patiently rubbing the hands over the face and neck, forcing the blood toward the large vessels and heart; or by using bleaching solutions, the natural color may be restored. Can we get rid of the blood by withdrawing it from the body? No; first, because of the valves in the veins, which prevent the blood from flowing except in one direction, and that toward the heart; second, because of clots forming just at death which plug the vessels or instruments we use in our attempts to withdraw the blood. Some blood can be withdrawn by opening veins in the extremities and neck as you inject through an artery, but the amount is small. Elevation of the head will, of course, allow the blood to gravitate to more dependent portions of the body, and is useful in addition, to forcing the blood from the face by rubbing. Purging from the mouth is due to the escape of liquid from the lungs through the windpipe. If gas forms in the intestines, the pressure of the gas on the stomach and lungs, forces out their contents, and the body "purges." Hence, remove the gas to stop the purging, by piercing the intestines through the abdomen, at any point, with a trocar or knife. Purging from too forcible or too much injecting will cease without interference.

Renouard directs, "when the body is that of a stout, fleshy person, especially when some length of time has elapsed from the time of death, until the undertaker has been called in, and particularly if the body has been reclining in a horizontal position, the face, neck, and shoulders will be found highly congested with blood; the face, in fact, may be swelled and of a purple appearance, owing to the extravasation of blood into the capillary vessels under the skin * * * in such cases, and after the body has been removed and placed in a proper position on the cooling board, if the blood is not carried to some lower part of the body, by its own gravitation, it may be found necessary to cut into the jugular veins on either side of the neck, or only into one of them, an incision about a quarter of an inch; through this opening the congested blood may be let out, and the face will soon recover its original color. This process occupies about twenty minutes.

Difficulties from disease. Difficulty in embalming is sometimes due to organic disease, as where there is disorganization of tissues, or dropsy, or large tumors, or such disease of the arteries as causes them to rupture from the pressure of the injection. Such difficulties from disorganization of tissue are usually found in consumption of the lungs. The preservative fluid finds its way into the cavities in the lung, and may even rise in the trachea; this escape of liquid is attended with an audible sound with each stroke of syringe. If, therefore, cavities

are known to exist, extreme gentleness must be used in injecting; when rupture does occur, the chest must be opened, and a ligature be passed around the root of each lung. The injection is then made in the aorta.

Dropsy. The dropsical fluid in the thorax and abdomen must be removed. The preservative liquid causes coagulation in the dropsical accumulations of the trunk and limbs and this obstructs the instrument.

The greatest force may be insufficient to make the injection flow freely; if punctures are made to let out the dropsical fluid, the injection escapes also. Richardson advises in such a case to give up injection by the arteries and inject by the subcutaneous tissues through several hundred openings.

A large tumor should be removed, and also the organ in which it is developed. The injection may then be introduced through several arteries; where the arteries themselves are diseased, the utmost gentleness must be used in injecting, and the liquid should be injected into the arch of the aorta.

Precautions. The fewer and smaller the incisions the less loss of injection liquid; the injection should stop finally when there is strong pressure and the body begins to become swollen; it is well, though not necessary, to inject some of the liquid into the bowels and bladder; the operator should wear gloves, to protect from the acid fluid; liquid may escape from the nostrils for several days afterwards; the lips and cheeks may be slightly touched with rouge if necessary.

The mode of operation in all cases may be the same, but the nature and quantity of the injection will vary; *first*, with the climate and circumstances of the atmosphere; *second*, with the cause of death; *third*, with the age of the deceased; *fourth*, with the state of the body after death; *fifth*, with the length of time which has elapsed since death took place.

It has been demonstrated in a previous chapter that a high temperature is conducive to rapid decomposition of organic matter; also, that a warm, moist atmosphere will operate in the same manner. It is, therefore, incumbent upon the operator to guard against these two agents of putrefaction, by keeping the body in a moderately cool and well ventilated place, until the work of preserving is accomplished; also, to give the antiseptics employed, time to successfully destroy and render harmless the dangerous effects of the heat.

It must not be understood by the preceding caution that a body cannot be embalmed in an ordinary room during the heat of summer; but the suggestion herein given is solely for the purpose of facilitating the operation and rendering the success certain; besides, the strength as well as the quantity of the injection must be increased when used during the warm season.

As to the modifications to be observed in the treatment of bodies when the cause of death is taken into consideration. In cases where death is the result of a certain class of diseases, the body is more prone to putrefy than in others; whilst in other cases again the body is, to a certain extent, preserved from corruption by the agents which have proved fatal to the organism; as, for instance, when death has been the result of poisoning, either by alcohol or arsenic.

The age of the person deceased and the conditions of the body after, as also the length of time elapsed since death took place, as affecting the mode of treatment, have all been discussed in the section on Putrefaction, and it is not necessary to repeat the same over again.

The important point which we have to press on your mind is, that circumstances in every case are to be investigated; also, that a uniform treatment of all cases will be a failure; and that a thorough knowledge and experience are necessary to achieve satisfactory results.

Discrimination and judgment are to be used in every case. Some are too ready to condemn a certain process, or to question the properties of some antiseptics, because the first trial of either has proved an ignominious failure; whereas, the real cause of all the trouble lies in their ignorance of the laws which govern the mode of proceeding, and the use of the chemicals placed at their disposition.

Others, again, are prone to extol the merits of some preparation, the component parts of which they do not know, but it may have done them good service in several instances; and when, contrary to their expectations, it fails to answer the purpose, they lose faith in it, discard it altogether as worthless, and never entertain the idea that an alteration of the quantity used, or in the combination and strength of constituents, is the real source of mischief. Hence, it is a fact and not to be denied that a diagnosis is necessary before the work of embalming is entered into. And he who would endeavor to preserve the body of a stout, fleshy person by the same means employed in the preserving of a body emaciated by long suffering, and under different conditions of temperature, will not meet with success equal to his expectations.

To prevent purging a simple method is to dispose of the gastric juice of the stomach by injecting into the nose or mouth *one or two ounces of an aqueous solution of any powerful antiseptic*, and after a few moments carry the head off the bed, and by gently pressing the stomach, empty its contents. This will prevent further difficulty from purging, if refilled with the solution and carefully sealed. Insert an instrument into the trachea, and thus give vent to the gases in the lungs, and inject full of the solution.

In hot weather it is well to wrap the body, after injection, in cloths soaked with carbolized glycerine. The inside of the mouth is usually

filled with tow, to prevent the sinking in of the cheeks, and the nostrils are also treated in the same manner, and for a similar purpose.

The wind-pipe should be opened and a cork placed in it, when during the injection the fluid escapes through the mouth.

The eyelids may be brought evenly together, and if necessary, secured by one or two stitches of fine silk, the nostrils carefully plugged with fine cotton-wool saturated with zinc colloid; the mouth brushed with zinc colloid; the lips neatly closed, if necessary, with one or two minute stitches under the mucous membrane. The body may now be wrapped evenly with bandages saturated with carbolic or zinc colloid. The bandaging should commence at the feet, each lower limb being wrapped separately; above the hips the bandages should cross, and should be passed in alternate crossings so as to incase the trunk quite up to the neck; they should here again diverge and extend down the arm on each side to the wrists, where they should end. The hands and face are then left exposed. The body may now be clothed, the hair arranged, and the body removed to the shell. If to be conveyed by sea, the shell, between the body and lid, should be packed with a blanket or pillow to prevent disfigurement from the motion of the ship. (Richardson.)

A thin coat of perfectly transparent varnish is sometimes applied to all parts of the body and face which are not covered by a growth of hair, and when dry the corpse is completely protected from the atmosphere.

EUROPEAN METHODS OF EMBALMING AND PRESERVATION OF THE DEAD.

The following process, which has been successfully employed in Europe, especially in France and Italy, for a long time, for embalming bodies and for the preservation of anatomical preparation, is still practiced extensively, owing to the cheapness of the materials used, and its simplicity.

Lay the body on an inclined board, as described in a former chapter, and after thoroughly cleansing with water and soap, saturate well with a concentrated *solution of alum*; the body should be kept well moistened with the solution in the same manner as above described until the operation is completed.

Through an opening made in the skin of the abdomen, and immediately over the traverse part of the colon; the bowels and the stomach will then be revealed, and must be emptied of their contents and properly cleansed, and injected with the preparation.

After the contents of the abdomen have thus been treated, the whole abdominal viscera are to be heavily sprinkled over with tannic acid, until the acid forms a layer of about one-half inch in thickness between the

bowels and the skin of the abdomen; the flaps of the skin are then brought together and neatly sewed up. Make an incision on the right basilic vein, and the blood in some cases, will issue very freely, and the flow of it must continue until the embalming fluid makes its appearance.

To inject the circulatory system, extend the left arm at a right angle with the body and open the axillary artery, about three inches from the armpit. The axillary artery is a continuation of the subclavian artery: it passes through the axilla or arm pit into the arm, hence is called the axillary artery; that part of its continuation into the upper arm is called brachial artery, and in the fore arm, it divides into the radial and ulnar arteries, which are distributed to the hand and fingers. (See Plate IV.)

Through the opening thus made in the axillary artery, two gallons of embalming fluid may be injected slowly and steadily, or such quantity as may be found necessary to completely fill the arterial and venous systems.

After the blood has ceased to flow from the opening in the basilic vein the wounds must be sewed up, and the body moistened with the solution, is left to dry in a cool, well ventilated place.

The surface of the body, as also the face may be mottled in some places with white spots, but the skin will soon assume a uniform color, and the blotches will disappear.

After the solution on the body has become sufficiently dry, and has penetrated the pores of the skin, the excess of moisture must be wiped off with a clean towel.

The nostrils should be hermetically sealed, by introducing into them some cotton, well saturated with gum shellac dissolved in alcohol.

The eye caps must be introduced under the eyelids as mentioned in the former chapter, and the eyes well closed. The body is then saturated with a thin coating of turpentine; and after the turpentine is dry, the clothing can be put on, and the body is then ready for interment."

This process is very simple, and has given satisfactory results.

Lecanu thus describes his process: "The body of a man, aged thirty years, who died of typhoid fever, was brought in for dissection. The external appearance of the corpse presented strong marks of dissolution. The abdomen, already slightly tinged with greenish streaks, was distended with gas; the neck and lower part of the face showed unmistakable signs of swelling, and the evolution of internal gases caused a frothy mucus to appear at the corners of the mouth, the popliteal artery was uncovered and the canula of a syringe containing the injecting fluid (See formula 49) introduced into the vessel. Gradually the abdomen resumed its normal size, the bluish green tint of the skin faded perceptibly. After injecting the *seventh litre* mucus was rejected from the

mouth. The operation was then suspended, and the artery firmly tied up. The canula of the syringe was then inserted and the lower parts of the limbs treated in a similar manner. On the next day the incipient swelling of the head and neck had disappeared, and the discoloration of the abdomen scarcely visible. *Nine weeks* afterwards the subject was still in a state of perfect preservation, in spite of adverse circumstances, and was used in the prosecution of anatomical studies.

Lacorolli, of Genoa, who, according to all accounts, is one of the most successful of modern embalmers, uses a solution very like Lecanu's, consisting of carbolic acid, the chloride of zinc and mercury, and some odorous substance. The details of his process have not yet been published in this country, though doubtless will be before long, for a short time ago he read a paper at a meeting of the Medical Society of Genoa, in which he gave a full explanation of his process.

Prof. Laskowsky, of the University of Geneva, who is also a very successful European embalmer, is reported to use an injecting liquid consisting of a mixture of carbolic acid, chloride of zinc, and corrosive sublimate with the addition of an odoriferous essence. This solution is as clear as crystal and pleasant to smell. A body skilfully treated by Prof. Laskowsky's method, assumes immediately after death, "the natural and agreeable expression" it bore, and the skin becomes firm and as white as Carrara-marble.

The proportions of the ingredients used are not known, and do not appear to have been published. In 1877 he used a mixture of glycerine and carbolic acid in crystals, injecting about 5 quarts; the vessels were filled in twenty minutes. The bodies are well preserved, but the skin becomes brownish in time. The liquid was prepared by liquifying the carbolic acid in a capsule, mixing it with a little glycerine heated to 176 degrees F. over a water bath, and pouring this into the remaining glycerine, stirring with a glass rod until well mixed.

THE BRUNETTI PROCESS OF EMBALMING.

1st. Washing out the circulatory system of the body with cold water until the water comes back clean. (Takes from two to five hours.)

2d. Alcohol similarly used to extract water. (One-quarter of an hour.)

3d. Ether to remove fatty matter, from two to ten hours.

4th. Strong tanning solution is allowed to percolate for two to ten hours.

5th. Body then dried in a current of warm air passed over calcium chloride, and after two to five hours becomes hard as stone and will keep indefinitely. (For details see English patents.)

The Italians exhibit specimens which are as hard as stone, retain the shape perfectly and are equal to the best wax models.

In this process it will be noticed that those substances most prone to decay are removed and the remaining portions are converted by the tannin into a substance resembling leather, and thus effectively protected against decomposition for years.

It is a matter of record in Vienna, that deceased members of the imperial family, whose bodies were embalmed about twenty-three years ago, are at present in a perfect state of preservation; although perhaps the features are a little more angular, the skin may have acquired a slightly yellow tinge, still, the familiar expression remains unchanged, and the aspect of the countenance has not varied; but truth compels us here to say, that in all cases mentioned, the bodies have been as usual hermetically sealed in lead caskets.

At the inception of this work, Prof Billings, then in Europe, was especially requested to investigate the subject of embalming and funeral customs as practiced abroad. His interesting account just received, is reproduced here entire:

“In the large cities of France, Germany, Italy and Austria, mutual coöperation burial societies exist: these societies, like mutual life insurance companies in this country, having grades of different degrees. Any person can become a member upon the payment of a certified sum of money and the payment during life of a certain sum in monthly or yearly installments. The poor insure themselves the cheapest form of funeral; the better class and the rich paying for more elaborate and sometimes magnificent funeral display. A necessary part in all funerals is the ‘*mute*’—a paid mourner, dressed in black uniform—with tall silk hat in Paris, and with cocked hat in Germany, Austria and Italy. These ‘*mutes*’ precede and follow the plain or magnificent hearse or funeral car, as the case may be. In Paris, one may see the coffin carried upon a stretcher by *two* ‘*mutes*’ while the mourning friends walk behind; this being the cheapest form of funeral. The number of the ‘*mutes*,’ like the decorations of the hearse, is proportionate to the amount paid during life by the deceased or friends. In Catholic burials the ‘*mutes*’ carry long wax candles for some distance beyond the church. The drivers of hearses and carriages in the funeral train wear cocked hats, and in the higher grade of funerals coachmen and coaches are draped. Funeral wreaths and flowers are hung upon the exterior of the hearse, upon leaving the church, and are left finally upon the grave or monument. The friends, the true mourners, always walk behind the hearse to a point beyond the area in which the tolling bell of the church is heard; they then follow in omnibuses or coaches, to agree with the grade of the funeral. At Paris, and in all France, too, all males raise

the hat, and females make the sign of the cross when a funeral is passing. This is an invariable custom, whether the deceased be rich or poor, young or old. At Munich, *all* recently dead are taken to a large building adjoining the cemetery and are placed in rooms and compartments, fitted up in different styles to suit the amount of money paid for the flowers, '*mutes*' and other funeral expenses. Some bodies lie imbedded in flowers, others, the very poor, lying upon plain boards. All bear numbers corresponding to the numbers and names of the dead, hung upon the entrance to the building. The bodies are clothed in funeral attire and are left in these rooms, cooled by ice for forty-eight hours. To the right-hand of each body is connected a hanging wire which communicates with a bell in the office located in the room above. Should a corpse show signs of life, and by movement ring the bell, a watcher at once rushes to the rescue. The primary object of the above plan was to prevent the burial of the living, but it is now a settled form of procedure for all Munich. The building now has a church adjoining, and the cemetery being so near, no hearses are used, the '*mutes*' carrying the coffin upon a stretcher-like bier. The cemetery at Munich is a gallery of art, of fine statues, busts and other sculptured work. At Vienna the coöperative burial business is carried out more uniformly than elsewhere. It seems to be *the* desire of the common folk to be buried well; that is, with ceremony. One woman, a shop-keeper, had paid into the society 8,000 guilden (about \$3,200), and her funeral was resplendent in '*mutes*,' mourning coachmen, coaches, wreaths and flowers.

"Embalming is not practiced anywhere in Europe to the extent that it is in the United States. At Vienna *post mortem* examinations are commonly made, and no attempt is made to inject the vessels. What the method of embalming is where the attempt is made, is jealously kept secret by the coöperative societies. Material for dissection in the medical college is used fresh; no preserved material being used. This is the practice, too, at Berlin. At Heidelberg anatomical material is preserved in 50 per cent alcohol, each body being sealed in a zinc-lined box filled with the alcohol. At Paris, the method of embalming is kept secret, and is rarely practiced, only with the rich. Anatomical material is preserved by means of solutions of zinc chloride, arsenic and corrosive sublimate, injected into the arteries. At the morgue, in Paris, where the unknown dead are exposed for three days to the public gaze, for the purpose of identification, the bodies are preserved by lowering the temperature by means of ice."

Later information from Paris states that in the Parisian medical schools, bodies are injected through the aorta, through a small opening made in the middle of the sternum, with a mixture of glycerine, carbolic acid and arseniate of soda which it is said, preserves the bodies admirably.

ENGLISH PATENTS.

Careful examination has been made of the records of all English patents for the preservation of the dead since 1838; and while they will be more fully detailed under the appropriate section of formulæ, etc., the more important of them will be briefly alluded to here, although none of them have attained that popularity their inventors desired.

1838.

November 6.—Luke Hebert took out letters patent (7856) for the preservation of corpses by means of arterial injection of a solution containing acetate and sulphate of alumina, to which was added one-twentieth part of arsenious acid. After embalming, the corpse was dressed in clothing saturated with a mixture of various preservative and aromatic liquids, and wrapped in oil skin.

1851.

Le Comte de Fontaine Moreau describes a process of using sulphate of zinc for injections, and also the same substance combined with emollients for the cure of gangrenous wounds and similar external diseases (No. 13,739).

1857.

(No. 2,060). A French chemist, Pierre Baboeuf, patents an invention for embalming bodies, preserving skins and the coloring of silk, wool, bone, feathers, etc., as well as for the destruction of insects and the preservation of animal and vegetable life from insects and animalculæ. He employed for this purpose vegetable and mineral oils, oils containing saponifiable acid, etc. The intestines were removed from the body, and the cavity filled with hemp saturated with essential oils. Or the body was to be immersed for 48 hours in a solution of alkaline phenates (carbolates).

1859.

(No. 1708). Zephirin Orioli obtained letters patent for the application of hypochloride of alumina to preserving and embalming bodies, as being an antiseptic having the power to destroy the fermenting matters present.

1863.

(No. 909). Henry R. Spicer claimed as an inventor the employment of glass for the manufacture of boxes or cases for preserving human remains; and specified as advantages that such boxes might be hermetically sealed, and they were therefore free from all emission of effluvia; that the material was durable, economical and portable.

In 1863 (No. 412) Mr. Morgan of Dublin describes his method for embalming. The sternum is to be cut down the center. The pericardium is to be opened so as to expose the surface of the heart. An incision is then made in the left ventricle, or in the aorta, and a pipe about eight inches long introduced into the heart, and connected with

tubing about fifteen feet long, which is joined at the further end with a vessel for fluid, raised about twelve feet above the subject. The tip of the right auricular appendix is then to be cut off; half a gallon of saturated solution of common salt, containing also four ounces of niter dissolved in it, is to be introduced into the raised vessel referred to, and then allowed to rush through the circulatory system. When the fluid has ceased running from the incision in the right auricular appendix, put on a clamp, or otherwise seal or close it. A solution of salt, niter, alum and arseniate of potash is then put into the vessel and allowed to run into the subject for a few minutes. It is claimed that this process will keep bodies for a considerable time.

1864.

(No. 926). Audigier, a chemist of Marseilles, patents a process consisting in the application of a composition of wood powder, nitric acid, marine or bay salt, and essence of lavender and thyme. He takes about forty-four pounds of this powder and spreads it all about the body. Thirty-one and one-half ounces of a liquid composed of nitric acid, marine salt and crystallized sulphate of zinc is introduced into the mouth under the tongue. It is claimed that mummification will take place in less than a year.

1866.

(No. 642). Victor Larnarides patents the following embalming, purifying and preservative fluid: Consisting of water, sulphate of zinc and copper (See formula No. 54).

Robert Lake the same year patents (No. 1,044) the use of antiseptic gases for preserving the dead, also carbolic acid (No. 1,602).

1867.

(No. 1,850). Professor Brunetti's method. Page 301.

The body is first washed internally and externally with water, and the blood is removed by injections of water in the excretory vessels and ducts, providing a suitable aperture for the escape of the water: the fat is then removed by the injection first of alcohol and then of sulphuric ether: the ether is then expelled by injections first of alcohol and then by continued injections of water. For tanning the tissues, tannic acid is dissolved in boiling distilled water, and injected into the arteries, veins or ducts.

The subject is placed in an iron oven with double sides, in which is contained water at the boiling point, so as to raise the temperature in the oven to about 92° Centigrade. For applying internal heat, hot air is compressed by an air pump in a strong receiver made to communicate with the arteries, veins and ducts by means of india-rubber tubing, whereby the air is allowed to penetrate to the primitive tissues. The air is heated and dried before entering the body.

(No. 379). Lewis Spear uses an injection fluid composed of a solution of sulphite of soda neutralized with sulphurous acid.

1873.

(No. 3,871). Dr. Lindemann patents an injection fluid composed of a saturated solution of boric acid in benzol, and the next year (1753) a solution of one part of boric acid, two parts of carbolic acid, and seven parts of water or alcohol colored with some carmine.

1874.

(No. 834). Napegyi's invention consists in employing hydrate of methyl and the acetate of the oxide of ethyl for a bath in which the body is to be preserved.

1876.

(1,969). Robottom used borate of lime for dusting the surface of the body to be preserved.

1877.

(1,022). J. W. Drake, of Canada, patents a formula (See formula 81) which, when being thoroughly injected renders, it is claimed, decomposition almost an impossibility.

1878.

(1,766). C. Laurent employs a mixture of three parts bicarbonate of soda to two parts of sugar.

1879.

(1,574). Wickersheimer claims that his mixture preserves bodies and combines flexibility and color of the parts. The following ingredients are employed: Alum, salt, niter, potash, arsenious acid, glycerine and methyl-alcohol.

1880.

In 1880 (1,916), he adds salicylic acid as an ingredient (See details next page).

1884.

In 1884 (6,109), R. Strauss, of Germany, sets forth the nature of an invention for a new apparatus for preserving dead or supposed dead bodies till burial, consisting of a receptacle, air tight except that it communicates with an air opening from below, and has a lamp situated above in such a manner that its burning causes a movement of cooled air through the apparatus, which air is consumed by passing through the lamp mentioned. There is also an alarm attached to the supposed corpse whose least movement causes a bell to ring.

French and German patents for this purpose are not accessible at the time of writing, but may be found in the appendix, with a single exception, that of the famous Wickersheimer fluids mentioned under the English patents. Wickersheimer's specifications are given in full, to-

gether with its claims, which have not been realized in the experience of the writer.

To all whom it may concern :

Be it known that I, Jean Wickersheimer, of the city of Berlin, in the kingdom of Prussia, and German Empire, have invented a new and useful compound, the composition of which, and the manner to use it are fully described and set forth in the following specification :

The invention relates to that class of compounds used to preserve dead human and animal bodies and vegetables; and its object is not only to protect these objects against putrefaction for a very long time, but to preserve their natural form and flexibility as well as their colors in perfection.

To prepare my compound, dissolve first by weight, one hundred parts of alum, twenty-five parts of common salt, twelve parts of nitre, sixty parts of potash, and ten parts of arsenious acid in three thousand parts of boiling water, and let the solution cool down and settle. Afterwards filter it. The result is a clear, colorless and odorless liquid, which must react neither acid nor alkaline, but be neutral. Then take, by measure, four parts of glycerine and one part of methyl-alcohol, and mix with them ten parts of the fluid aforesaid.

This mixture is my compound for preserving dead human and animal bodies and vegetables.

To preserve anatomical preparations, as skeletons with natural ligaments, cancers, beetles, and similar objects, which shall be kept afterwards in a dry state, they are put in the compound for about six to twelve days, according to their size and volume, then removed from the compound and air-dried, after which treatment they are ready to be placed in the museum.

They remain flexible for years, maybe forever, and can be made at any time to produce all the natural movements of the living object.

Hollow objects—to-wit, lungs, bowels, or similar parts—are filled with the compound and put in the same for six to twelve days, after which time they are taken out of the compound, emptied and air-dried.

It may be remarked here that it is advantageous to inflate such hollow preparations, especially bowels, previous to their air-drying.

Lizards, snakes, and similar objects, also vegetables, are preserved by keeping them submerged in the compound, as the main object commonly is the preservation of their color. Otherwise they are air-dried after six to twelve days' impregnation with the compound.

To preserve dead human or animal bodies, be it for scientific purposes or for embalming the former, the compound is forced by a syringe into an artery, in which is made, for that purpose, an incision to receive the mouth of the syringe.

The quantity of compound to be applied varies from about one and one-half quarts to five quarts and more, according to the volume of the body to be treated.

The injection should be made as soon after death as possible, as it indeed excludes and stops putrefaction, but cannot restore already destroyed organic formations.

Bodies treated with my compound will show for years the flesh, the muscles, the tissues, even the soft parts, perfectly, in the same state as they were in when injected.

In case of embalming it is advisable to rub the whole corpse on the outside with the compound after the injection is made, or after the impregnation, if such is preferred, and to inclose it in an air tight vessel or coffin. Not only the form of the dead will then be preserved, but the epidermis will also retain its natural color.

I know very well that single ingredients of my compound have been tried for similar purposes; but all these previous attempts have, so far as I am aware, failed to produce the preservation of the bodies, combined with the flexibility and color of their parts.

I claim as my invention:

1. A compound for preserving, consisting of glycerine, methyl-alcohol, and a solution of mineral antiseptics, in which alum is the chief ingredient, substantially as described.

2. A preservative compound, consisting of glycerine, methyl-alcohol, and a solution of alum, salt, niter, potash and arsenious acid, substantially as, and in the proportions specified.

This specification signed by me this 5th day of April, 1879.

JEAN WICKERSHEIMER.

AMERICAN PATENTS.

About fifty patents have been issued by the United States Patent Office since 1858 for embalming and preserving organic matter. They mainly are designed for use in the curing of meats, as will be seen by the following chronological list:

1858.

November 30.—No. 22,185 to N. B. Marsh for preserving meat.

1861.

September 10.—No. 32,228 to J. C. Adams for improvements in meat curing apparatus.

1872.

August 6.—No. 130,232 to J. A. Mitchell, for improvements in preserving dead bodies. (By means of tight ice chest and antiseptic vapors of alcohol, sulphuric ether, carbolic acid, corrosive sublimate, arsenic and chloroform.)

1874.

February 24.—No. 141,984 to G. W. Scollay, for improvements in preserving meat and animal matter. (By means of carbonic oxide and sulphurous acid gas and a solution of the sulphites of the alkalies, or their borates or bborates.)

June 9.—No. 151,632 to F. W. Fox, for improvement in apparatus for injecting brine into meat.

October 20.—No. 156,051 to Thos. H. Whitehouse, for improvements in embalming or preserving dead bodies. (By means of charcoal, sulphate of iron, permanganate of potassa. See formula, 13.)

December 8.—No. 157,446 to Jas. F. Gyles, for improvement in process of preserving meat. (By means of smoke and brine and an air-tight receptacle.)

1876.

February 29.—No. 174,071 to Henry Galulliam, for improvement in

process of preserving meats. (By means of 4 to 5 per cent of acetate of soda.)

February 29.—No. 174,085 to Geo. T. Parker, for improvement in embalming apparatus.

November 7.—No. 184,134 to John C. Howard, for improvement in process of preserving meats. (By means of salicylic acid and glycerine.)
1877.

March 6.—No. 181,956 to C. G. AmEnde, for improvement in composition for preserving. (By means of powdered boracic acid and chloroform or chloral hydrate.)

March 6.—No. 188,093 to Fred. S. Barff, for improvement in preserving animal and vegetable substances. (By means of the hydrated lower oxides of manganese and iron, etc.)

August 28.—No. 194,550 to John Eckart, for improvement in preserving flesh and fish by salicylic acid.

August 28.—No. 194,569 to John L. Alberger, for improvement in process for preserving flesh. (By means of saline injection containing also carbolic or salicylic acid.)

October 2.—No. 195,758 to Geo. L. Gray, for improvement in process of curing meats. (By continuous flow of pickle over them).
1878.

March 19.—No. 201,344 to Edward Gorges, for improvement in powders for curing meats. (See formula No. 132.)

April 30.—No. 203,033 to Albert H. Hatch, for improvement in apparatus for embalming.

July 23.—No. 206,343 to Richard J. McGowan, for improvements in embalming compositions. (See formula, No. 137.)

August 27.—No. 207,551 to Samuel Rodgers, for improvements in tubular needles for embalming.

1879.

July 22.—No. 217,779 to James M. Dillon, for improvement in processes for preserving meats. (By means of ordinary salt impregnated with smoke.)

November 11.—No. 221,541 to Lozengo Fagersten, for improvement in processes for preventing mold upon meats. (By means of a hot solution of boracic acid.)

December 9.—No. 222,521 to Jas. H. and Henry B. McCarty, for improvement in fluids for embalming. (See formula: No. 1389.)

1880.

March 30.—No. 226,136 to Henry Warden, for process for preserving meats. (By means of arterial injection of cold, blood-warm, or hot pickle until it escapes clear from the venæ cavæ and then follow by injections in the same manner of air or oxygen gas.)

May 18.—No. 227,654 to Samuel Rodgers, specifications in embalming process. (Viz.: injection by means of hollow needle at the umbilicus and into the brain cavity through the nose with making other incisions.)

May 25.—No. 228,016 to Filippo Artimini, for compound for preserving meat. (See formula, No. 141.)

June 8.—No. 228,519 to Peter C. Doremus, for process and compound for embalming and preserving animal substances. (By means of saltpeter water impregnated with sulphurous acid gas.)

August 31.—No. 231,807 to Richard Jones, for process for preserving meat. (By means of arterial injections of a solution of boracic acid, 13½ oz. to gallon boiling water.)

November 16.—No. 234,567 to Julius Hauff, for compound for preserving animal and vegetable substances. (By means of a dry preserving compound consisting of a salt formed by the chemical union of borax and boric acid.)

November 30.—No. 234,844 to Wm. Archdeacon, for compound for preserving meats. (By means of salt and pyroligneous and salicylic acids.)

1882.

January 3.—No. 251,772 to John Eckart for compound for preserving meats, etc. (See formula, No. 142.)

May 16.—No. 258,001 to Frederick S. Barff, for preserving compound. (See boro-glycerine.)

November 21.—No. 267,684 to Anderson Fowler, for method of preserving meats. (By means of an electrolytic circuit.)

November 28.—No. 268,094 to Wm. F. Grier, for preservative for organic substances. (Viz.: 1,116 parts of boracic acid to 382 parts by weight of prismatic borax, heated together until water is evolved and then dried in a current of hot air.)

1883.

August 24.—No. 276,246 to James Howard for composition for preserving food, etc. (By means of a boro-phosphate of soda, viz.: 5 parts by weight of boracic acid to 1 part of phosphate of soda.)

1884.

June 24.—No. 300,989 to Arthur S. Lovett, for apparatus for embalming. (A flexible gas-tight case, and means for supplying and expelling gas from said case.)

1885.

April 7.—No. 315,272 to Chas. W. Gath, for device for embalming. (Corpse-supporting board, arm-rest, pump-clasp, etc.)

May 12.—No. 317,703 to Wm. T. Baker, etc., for apparatus for embalming. (Essentially a flexible, gas tight cover, bellows, pump, etc.)

July 21.—No. 322,541 to James Jackson, for device for embalming. (A salt-injecting instrument with piston in hollow blade, etc.)

October 20.—No. 328,577 to Porter Ensworth, for embalming apparatus. (Improvements on 317,703.)

October 27.—No. 329,140 to Joseph H. Clarke, for arm-rest for embalming tables.

1886.

May 9.—No. 337,707 to Harvey N. Siegenthater, etc., for embalming syringe.

The above comprises the list of American patents on this subject to date, and are published not so much for their real value as for information to those purposing patenting some device pertaining to the funeral directors art.

PRESERVATION OF ANATOMICAL MATERIAL.

One other department of this subject deserves our attention briefly and that is the preservation of bodies for anatomical uses. The requirements of medical colleges are not as exacting as those of private life, for a life-like appearance is not sought, but simply the preservation of material in proper shape for dissection. In order to find how this was best accomplished circular letters were sent to all the leading medical colleges of the United States, and the following replies received.

Albany Medical College: "We use chloride of zinc solution for injection, and immerse the bodies in brine."

Atlanta Medical College: "Have found a saturated solution of arseniate of sodium the cheapest, most convenient, and best of all."

Bellevue Medical College: "We inject our bodies first with a saturated solution of arseniate of sodium, and then with a mixture of plaster of Paris and lead, and preserve during the summer in a large refrigerator."

Buffalo University: "We inject through the femoral artery of the right side about 4 ounces of arsenious acid, and 6 of soda carbonate, (Formula 142), and two days later give a second injection through the same incision, of 2 parts of tallow and 1 of lard, colored with red aniline. During the summer the bodies are preserved in a large tank with simple brine."

Cincinnati College of Medicine and Surgery: "Always used chloride of zinc as an injection, having found it more convenient, if not better than other agents."

Chicago College Physicians and Surgeons: "Employ Rudinger's fluid (Formula 144), and then place in 65 per cent alcohol pickle; but are about to return to the freezing plan."

Chicago Medical College: "Use a saturated solution of arseniate of sodium for arterial injection, and keep in a chill room where temperature is kept constantly below 30° Fahrenheit."

Cleveland Medical College: "We use simply a solution of arsenic and soda (Formula 145.) for injecting, and then place the cadaver in a pickle made of a saturated solution of rock salt."

Columbus Medical College: "Inject through the carotid, while the body is floating in water, a saturated solution of arsenite of soda by gravity only, and then the cadaver is placed in strong brine."

Georgetown University: "Have found ample satisfaction in the use of one ounce of chloride of zinc to the gallon of water, injecting through the left carotid several hours before introducing the plaster colored with one of the dyes."

Hahnemann Medical College of Philadelphia: "Have found none equal to the solution of zinc chloride, injected in hot solution (1 to 2½) by the aorta."

Homeopathic Medical College of Missouri: "Use about one-half pound of chloral hydrate for the injection of each body."

Indianapolis Medical College: "Use equal weights of bicarb of soda and crude arsenic (2½ lbs.) in water (3 gallons) boiled for an hour or more, and it has given satisfaction."

Iowa State University: "Inject each subject with about 3 quarts of our preservative containing equal parts of white arsenic and carbonate of soda, and we try to get 15 ounces of arsenic and soda into each subject and keep in the refrigerator until needed."

Jefferson Medical College: "Inject our subjects through the thoracic aorta with equal parts of neutral chloride of zinc and water, and fill the vessels to repletion. In the summer season after the body is injected it is immersed in a saturated solution of salt and water, and kept there until needed."

Kansas City Medical College: "Always use a solution of bichloride of mercury and have gotten splendid results from it. (Formula 146.)"

Kentucky School of Medicine: "Arsenate of soda is the only chemical used for years."

Keokuk Medical College: "We use neutral chloride of zinc and inject while hot. Also use more often the arseniate of sodium and crystallized carbonate of sodium. (Formula 147.)"

Long Island Medical College: "Inject into the carotid artery by hydrostatic pressure a hot saturated solution of arseniate of soda, opening the jugular vein; at the least sign of decomposition we place them in brine until needed, but it is rarely needed."

Louisville Medical College: "Have used arseniate of soda and chloride of zinc, and like the zinc best." (1-4.)

Rush Medical College: "Uses Rademacher's Fluid (Formula 148.) and chill room."

Medical College of Ohio: "Use chloride of zinc solution prepared by

throwing scrap zinc into commercial muriatic acid so long as the zinc dissolves. This we dilute $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, as the case may require, generally the $\frac{1}{2}$ strength.

Medical College of Virginia: "Each subject is injected, through the common carotid, with spirits or water containing one-half pound of chloral. The same solution is thrown into the rectum and stomach, and the body is then washed with a solution of chloral, and is then ready for the tank, which contains a saturated solution of common salt, and about one pound of saltpeter."

Michigan Medical College: "We use an arsenic and bicarbonate of soda solution containing carbolic acid, and also one of saltpeter, brown sugar and alcohol. (Formulæ 149, 150.)

Michigan State University: "Use a saturated solution of arseniate of sodium, the quantity varying from two to three gallons, and throw into brine until used. Bodies for private dissection are injected with Wickersheimer's fluid." (Formula 100).

Missouri Medical College: "Uses a refrigerator, and injects its bodies with a solution of arseniate of soda and glycerine."

Portland Medical College: "Injects first a warm, saturated solution of coarse salt, throwing in all that can be done with a reasonable amount of force. Then a solution of arsenious acid and carbonate of soda in hot water (Formula 149) is injected; and have also used two ounces of glycerite of carbolic acid or two quarts of alcohol with good success."

St. Louis Medical College: "We are using for this year, to see how it acts, previously having used chloral hydrate, a solution of arsenious acid, carbonate of sodium and carbolic acid (eight ounces each of the first and two of the last to the gallon.)"

St. Louis College of Physicians and Surgeons: "We find nothing equal to a saturated solution of the arsenite of soda. Two injections are made with an interval of twelve hours between."

University of Louisville: "Use as an embalming fluid a saturated solution of arseniate of soda, and after embalming put in a refrigerator, in which the temperature is kept at about 30° to 32° F."

University of Maryland: "Have settled on arsenic as the most satisfactory material to use in preserving our subjects * * * a handful of salt is suspended in boiling water, and this while hot as possible is injected into the aorta, * * * and repeated until the solution returns clear through an opening made in the vena cava."

University of New York: "Material for the dissecting-room is injected with a solution of chloride of zinc, and kept in tanks filled with a solution of salt in water."

University of Pennsylvania: "Depend entirely upon the neutral solution of chloride of zinc for the preservation of anatomical material."

After thorough injection, the bodies are placed in tanks filled with a saturated solution of common salt. In winter use arsenic injections."

University of Vermont: "Use Formula 148, injected into the arteries, and like it very much, as it preserves the natural color of the tissues."

University of Tennessee: "Have been constantly using a fluid composed of arsenious acid, chloride of zinc, permanganate of potash, and hydrate of chloral."

SECTION VI.

150

SELECTED FORMULÆ ANTISEPTICS, DISINFECTANTS,

AND

INJECTION FLUIDS.

SECTION VI.

FORMULE FOR ANTISEPTIC AND PRESERVATIVE FLUIDS.

1. PREPARATION OF KYPHI.

The earliest disinfectant of which we have any account is one mentioned in the Papyrus Ebers, which was written 1552 B. C. It is called "the preparation of Kyphi, to make agreeable the odor of the house or dresses: dry myrrh, juniper berries, olibanum, mastic twigs, fenugreek seeds, raisins, * * * * *

Also use them as pastiles to make agreeable the odor of the mouth."

Chas. Rice.

2. RIQUET'S LIQUID BALM.

Riquet's liquid balm, which was used to preserve the body of Madame La Dauphine, consisted of turpentine, styrax, balsam copaiba and Peru.

3. BALM WHICH WAS MADE FOR MADAME LA DAUPHINE.

Florence iris root	-	-	-	-	-	-	-	3 lbs.
Rush -	-	-	-	-	-	-	-	1½ "
Bohemian angelica root, ginger, aromatic calamus, aristolochia,								
of each	-	-	-	-	-	-	-	1 "
Imperatoria, gentian, valerian, of each	-	-	-	-	-	-	-	½ "
Balmgentle leaves, basilic, of each	-	-	-	-	-	-	-	1½ "
Savory, sage, thyme, of each -	-	-	-	-	-	-	-	1 "
Hyssop, laurel, myrrh, marjory, origan, rhue, of each -	-	-	-	-	-	-	-	½ "
Southern wood, absynth, mint, calamint, wild thyme, odoriferous rush, scordium, of each	-	-	-	-	-	-	-	4 oz.
Orange flowers	-	-	-	-	-	-	-	1½ lbs.
Lavender	-	-	-	-	-	-	-	4 oz.
Rosemary	-	-	-	-	-	-	-	1 lb.
Coriander seed	-	-	-	-	-	-	-	2½ "
Cardamum seed	-	-	-	-	-	-	-	1 "
Cumin, carraway	-	-	-	-	-	-	-	4 oz.

Fruit, and seeds of the juniper	-	-	-	-	-	-	1 lb.
Cloves	-	-	-	-	-	-	1½ "
Nutmeg	-	-	-	-	-	-	1 "
White pepper	-	-	-	-	-	-	4 oz.
Dried oranges	-	-	-	-	-	-	3 lbs.
Cedar wood	-	-	-	-	-	-	3 "
Santal citron, roses, of each	-	-	-	-	-	-	2 "
Citron and orange peel, canella, of each	-	-	-	-	-	-	½ "
Styrax, calamite, benzoin, olibanum, of each	-	-	-	-	-	-	1½ "
Myrrh	-	-	-	-	-	-	2½ "
Sandarac	-	-	-	-	-	-	½ "
Aloes	-	-	-	-	-	-	4 "
Spirits of wine	-	-	-	-	-	-	4 "
Salt	-	-	-	-	-	-	4 oz.
Venice turpentine	-	-	-	-	-	-	3 lbs.
Fluid styrax	-	-	-	-	-	-	2 "
Balsam of Copaiba	-	-	-	-	-	-	½ "
Balsam of Peru	-	-	-	-	-	-	2 oz.
Cere-cloth	-	-	-	-	-	-	-

Riquet.

4. WORTMAN'S FORMULA.

Saturated solution of chloride of zinc (about equal portions chloride and water)	-	-	-	-	-	-	2 qts.
½ oz. corrosive sublimate in water	-	-	-	-	-	-	2 "
½ oz. carbolic acid crystals in water	-	-	-	-	-	-	2 "

Wash the vessels first with water, and inject the six-quart mixture, preferably by the carotid artery, both upward and downward.

5. MORRELL'S ANTISEPTIC LIQUID.

Arsenious acid,	14 parts.
Caustic soda,	7 "
Water,	20 "

Carbolic acid in sufficient quantity to make fluid opalescent, after which add water to make 100 parts.

6. MULLEN'S PRESERVING FLUID.

Bichromate of potash,	2 to 2½ parts.
Sulphate of sodium,	1 "
Water to	100 "

7. SOVEREIGN FLUID, Cincinnati, O.

Chloride potash,	18 ounces.
Alum powdered,	24 "

Arsenic solution,	12 ounces.
Chloride zinc,	9 “
Corrosive sublimate,	3 “
Alcohol,	30 “
Water,	4½ gallons.

8. AN ITALIAN FORMULA.

Boiling water,	1 gallon.
Arsenic,	2 ounces.
Cologne water,	½ gallon.
Alcohol,	½ “
Chloride of zinc,	3 ounces.

9. DR. PETRIE'S FORMULA.

Cologne spirits,	1 gallon.
Carbolic acid,	6 ounces.
Corrosive sublimate;	40 grains.

10. FORMULA.

Hydrate chloral,	2 ounces.
Glycerine,	2 “
Distilled water,	1 “

11. DR. WYWODZOFF'S FORMULA, NO. 1.

Thymolis,	2 scruples.
Glycerine,	4 pounds.
Water,	2 “

12. DR. WYWODZOFF'S FORMULA, NO. 2.

Salicylic acid,	2 drachms.
Borax,	2 “
Gum arabic,	1 ounce.
Water,	11 “

13. WHITEHOUSE'S PATENT EMBALMER.

Pulverized charcoal,	4 ounces.
Sulphate of iron,	1 “
Permanganate of potassa,	2 “

Mix with distilled water to about the consistency of cream.

The exposed parts to be coated with the following compound :

Spirits of ammonia,	3 parts.
Carbolic acid,	2 “
Tincture of iodine,	7 “

14. FORMULA.

Acetate alumina,	1 pound.
Corrosive sublimate,	2 ounces.

Dissolved in one gallon of water.

15. LIQUOR OF SIR S. SMITH.

Corrosive sublimate,	2 drachms.
Camphor,	2 oz.
Spirits of wine,	1 lb.

16. BITTER SPIRITUOUS LIQUOR.

White Soap,	1 oz.
Camphor,	2 “
Colocynth,	2 “
Spirits of wine,	2 lb.

17. NICHOLAS' LIQUOR.

Very pure water,	2 lb.
Alcohol,	1 “
Sulphate of Alumina,	6 oz.

18. GEORGE GRAVES' LIQUOR.

Alum,	8 oz.
Common water,	1 lb.
Alcohol,	$\frac{1}{2}$ “

The following is the method of preparing this mixture: The alum is pulverized and put into a vessel capable of resisting heat; water being heated to ebullition is poured upon the alum; when cool, it is to be filtered through gray paper, and then mixed with alcohol.

19. ABBE MANESSE'S FLUID.

Alum,	1 lb.
Nitre,	1 “
Sea salt,	1 “
Common water,	4 “
Alcohol,	1 “

20. RENOUARD'S NO. 3.

Acetate alumina,	1 lb.
Sulphate iron,	4 oz.
Corrosive sublimate,	2 “
Water,	1 gal.

21. DURANT'S BLEACHER.

Hyposulphite soda,	12 oz.
Sulphuric acid;	6 "
Water,	1 gal.

Acid sets free hyposulphurous which bleaches.

22. RENOUARD'S BEST INJECTION.

Alcohol,	1 gal.
Corrosive sublimate,	8 oz.

Then add two pounds creosote. Makes white mark. Use carefully.

23. EMBALMING FLUID.

Corrosive Sublimate,	2 ounces.
Chloride Zinc,	3 "
Alcohol,	$\frac{1}{2}$ gallon.
Dissolve the first ingredients in the alcohol then add	
Pyroligneous Acid,	$\frac{1}{2}$ gallon.
Creosote,	4 ounces.

For use on Internal Organs.

Renouard.

24. RENOUARD'S EMBALMING FLUID, NO. 2.

Corrosive Sublimate,	2 ounces.
Chloride Zinc,	4 "
Creosote,	4 "
Alcohol,	1 gallon.

Dissolve Corrosive Sublimate and Chloride of Zinc first in the Alcohol, and then add Creosote.

25. WORTH'S FLUID.

Arsenious Acid,	3 ounces.
Carbonate of Soda,	4 "
Water,	3 quarts.

Dissolve in a porcelain vessel the arsenious acid and soda in hot water. and after solution, let the liquid *cool off*; then add enough water to make up a *gallon*. In the making and using of this preparation, great care should be exercised, as it must be borne in mind that arsenious acid is a violent poison.

26. DR. ROSWELL PARK'S FLUID.

Brown Sugar,	2 parts.
Nitre,	1 "
Methylic Alcohol,	1 "
Glycerine,	10 "

27. W. W. KEEN'S CHLORAL SOLUTION.

Chloral Hydrate,	3 to 5 pounds.
Water,	6 to 8 “

28. CAMPHORATED ACETIC ACID.

Camphor,	$\frac{1}{2}$ ounce.
Acetic Acid,	$6\frac{1}{2}$ ounces.

Dissolve the camphor with the aid of a little alcohol and then add the acetic acid.

To remove fetid odors.

A. Renouard.

29. GANNAL'S FLUID.

Sulphate of Alumina,	4 pounds.
Arsenious Acid,	4 ounces.
Creosote,	4 “
Water,	1 gallon.

Use transparent arsenic, heat the water to 55 C. and dissolve the arsenic first, then add the alumina and last of all the creosote.

30. RENOARD'S FLUID FOR LOCAL USE.

Alum,	8 ounces.
Corrosive Sublimate,	2 “
Water,	1 gallon.

Should be diluted one-half with water for use with children or persons with a thin skin. It should be kept from a strong light in dark glass bottles, and when used should never be mixed in a metallic vessel, but in a china dish.

31. BEFORE EMBALMING.

Sulphate alumina,	2 pounds.
Corrosive sublimate,	2 ounces.
Water,	1 gallon.

Apply to surface of body and allow to evaporate.

Renouard.

32. AROMATIC VINEGAR TO COVER DISAGREEABLE ODORS.

Camphor,	2 ounces.
Alcohol,	Sufficient to dissolve.
Oil of cloves,	1 ounce.
Acetic Acid ; very strong,	12 ounces.

Renouard.

33. MODIFIED GANNAL'S FLUID.

Sulp. alumina,	6 pounds.
Transparent arsenic,	4 ounces.
Creosote,	6 ounces.
Water,	1 gallon.

Especially adapted for fleshy people and for use in hot weather.

Renouard.

34. PACINI'S FLUID.

Bichloride of mercury,	1 part.
Chloride of iodine,	2 parts.
Glycerine,	13 parts.
Distilled water,	113 parts.

Let the liquid rest for two months, then add three more parts of distilled water and filter.

35. LATUR'S PRESERVATIVE FOR ANATOMICAL SPECIMENS.

Iodine,	5 parts.
Tartar emetic,	6 parts.
Distilled water,	500 parts.

Bromine may be substituted for iodine.

36. MOULLARDI'S PREPARATION.

Immerse the object for two weeks in the following solution :

Corrosive sublimate,	2 parts.
Glycerine,	20 parts.

Drain until dry and extend on the whole a coat of varnish.

37. A SUBSTITUTE FOR ALCOHOL IN PRESERVING NATURAL HISTORY SPECIMENS.

Phenic acid,	1 ounce.
Distilled water,	50 ounces.

38. FORMULA.

Common water,	5 lbs.
Alum,	1 lb.
Sea-salt,	$\frac{1}{2}$ lb.

Bath employed by naturalists.

39. TANNING LIQUOR.

Tan, or oak bark,	1 lb.
Powdered alum,	4 ounces.
Common water,	20 lbs.

40. ABBE MANESSE'S LOTION.

Alum,	1 lb.
Sea-salt,	2 oz.
Cream of tartar,	1 oz.
Common water,	4 lbs.

Employed externally as a lotion.

41. INJECTING FLUID.

Salt,	4 ounces.
Alum,	2 “
Corrosive sublimate,	2 grains.
Water,	1 quart.

42. FOR PRESERVING SPECIMENS OF MYOLOGY.

Brown sugar,	5 ounces.
Common salt,	10 “
Nitrate of potassa.	7½ “
Distilled water,	½ gallon.

This preparation preserves the color of the muscles.

43. VAN VETTER'S PREPARATION.

Glycerine,	1 pint.
Brown sugar,	2 ounces.
Saltpeter,	2 “
Distilled water,	½ gallon.

44. HEIDMER'S FLUID.

Arsenic,	5 oz.
Alum,	1 lb.
Saltpetre,	1 “
Boiling water,	2 gals.

After cooling add

Sulphate zinc,	1 lb.
Alcohol,	1 gal.

45. VIVODTSEF'S SOLUTION.

Thymol,	5 parts.
Alcohol,	45 “
Glycerine,	2160 “
Water,	1080 “

46. RENOUDARD'S FLUID NO. 4.

Dissolve in 1 gallon of water as much alum as it will take up, then filter or pour off clear liquid and add to it 2 ounces chloride of zinc and 2 ounces corrosive sublimate. Keep cool and do not put in metallic vessels, and may add, in warm weather,

Creosote, 1 ounce to the gallon.

47. RENOUCARD'S NO. 5.

Two pints of water at 50° F.: add chloride of zinc until the fluid is unable to dissolve more, then add 1 pint of water and 2 pints of methylated spirit.

48. FOR LOCAL USE.

Alum,	8 ounces.
Corrosive sublimate,	2 “
Distilled water,	1 gallon.

49. LECANU'S FLUID.

Alcohol,	8 parts.
Water,	8 “
Glycerine,	8 “
Carbolic acid,	6 “

50. INJECTING FLUID.

Chloride of alumina,	2 pounds.
“ sodium,	1 “
Corrosive sublimate,	4 ounces.
Carbolic acid,	2 “
Water,	1 gallon.

51. PRESERVATIVE FLUID.

{ Corrosive sublimate,		
{ Carbolic acid	—of each,	20 grams.
Brandy,		2 litres.

52. PROCESS OF DR. TRANCHINI.

This process of embalming consists of injecting in the crural arteries one gallon and a half, or two gallons, according to circumstances, of the following solution: *Two pounds of arsenic in ten pints of distilled water, or in brandy.* It is evident that a greater part of the arsenic injected is held in suspension in the liquid; for in the above preparations it can not be easily dissolved. According to the authority of different writers, bodies thus treated can be preserved indefinitely but they desiccate in a rather short time.

53. HOMOLLE'S SOLUTION.

Sulphate of alumina is frequently employed for the preservation of bodies; but this salt being always acid, *Dr. Homolle* saturates its solution with *oxide of zinc* and thus obtains a compound forming a *sulphate of zinc and alumina*, which is employed with advantage for the purpose named.

54. ANDIGIER'S PATENT—ENGLISH.

Sulphate of zinc	26½ lbs.
“ “ copper	8 oz.
Natural water	100 lbs.

55. DR. CARRA'S PROCESS.

The venous system is emptied, and the arterial circulation filled with a solution of:

Chloride of alumina	6 lbs.
Corrosive sublimate	3 oz.
Distilled water	6 litres.

The body is then immersed in the same solution for sixty days; and at the end of that period of time presents the phenomena of petrification.

56. SUEVERN'S DISINFECTANT.

The component parts of this solution are lime, chloride of magnesium, coal-tar and water. Hausmann's experiments have shown that lime, of itself, is able to clarify the turbid contents of sewers, while it retards the development of infusoria and fungi until the tenth day. The strong ammoniacal smell which follows its use may be overcome by adding one part of the chloride of magnesium to ten parts of the lime. The development of the low microscopic organisms are retarded for a much longer time by the further addition of tar.

57. THE INJECTION OF ANATOMICAL PREPARATIONS.

A. K. Bijeloussow recommends (*Archiv. f. Anatomie*, November, 1885) for this purpose a mixture of borax and gum arabic. The mass is injected cold, and is then fixed by immersion in spirits. By treating the preparation with glycerine the injection is rendered transparent; and it can be removed at any time by acting upon it with dilute acetic acid. *The American Journal of the Medical Sciences*, April, 1886.

58. MUSCROFT'S DISINFECTANT.

Dr. Muscroft, of Cincinnati, Ohio, recommends:

A disinfecting fluid composed of 1½ ounces of the bicarbonate of soda and one ounce of powdered alum, dissolved in water. He uses this mixture also for every kind of sloughing sores.

59. LASKOWSKY'S INJECTION.

Glycerine (28°),	1000 parts.
Carbolic acid (crystals),	100 “

About five quarts to be used for an injection.

60. DORRAULT'S POWDER.

Sawdust,	5 pounds.
Sulphate of zinc in powder,	2 pounds.
Essence of lavender,	8 oz.

61. HYRTL'S SOLUTION.

Acetate Alumina—	1 part
Alcohol 35 per cent,	12 parts

62. SOLUTION ALUMINA SULPHATE.

Alumina sulphate—puriss,	60 parts
Water	40 “
Zinc oxide,	6 “

Dissolve, filter and evaporate to density (38° Baume).

63. SUCQUET'S SOLUTION.

An aqueous solution of chloride of zinc (40° Beaume) containing about 35 per cent. For injection this is diluted with one-fifth volume water. About four quarts are injected via the popliteal artery and into the abdomen.

64. B. W. RICHARDSON'S SOLUTION, NO 1.

1. *Chloride of zinc* five parts and alcohol one part. The chloride is added to water at 50° F. to the point of saturation. A body of 100 pounds weight would require about six pints of the mixture which should be already prepared before embalming begins. The transfusion should be rapid to prevent contraction of the blood vessels, which may occur from too long contact of the liquid with the arterial wells. The color of the body afterwards is almost pearly white.

65. RICHARDSON'S SOLUTION, 2.

Chloride zinc 20 grains in styptic colloid 1 fluid ounce.

66. RICHARDSON'S SOLUTION, 3.

Chloride zinc,	4 pounds.
Glycerine,	1 pint.
Water,	1 gallon.

67. STRAUS-DURKHEIM'S FORMULA.

Zinc sulphate,	14 parts.
Water,	10 “
or	
Zinc sulphate,	1 part.
Water,	2 “

68. SANTER'S INJECTING FLUID.

Carbolic acid,	1 part.
Glycerine,	10 "
Alcohol,	50 "
Water,	40 "

Of this 6 to 8 pints are necessary for injection. If desired to preserve for several months a second injection is required, viz.:

69. SANTERS' STRONGER FLUID.

Chloride zinc,	1 part.
Water,	3 "

Added to 10 to 16 parts of fluid No. 1.

70. SESEMAN'S FLUID.

Arsenite of soda,	2 parts.
Carbolic acid,	2 "
Glycerine,	100 "
Water,	10 "

71. GOADBY'S SOLUTION.

Chloride of sodium,	4 ounce.
Alum,	2 "
Corrosive sublimate,	4 grains.
In boiling water,	2 quarts.
Filter well.	

72. FORMULA.

Glycerine,	14 parts.
Brown sugar,	2 "
Nitrate of Potash,	1 "

Dissolve and inject.

73. HOWSE'S ARSENICAL GLYCERINE.

White arsenic,	1 pound.
Glycerine,	2 pints.

Heat the glycerine to dissolve the arsenic, and filter before using.

74. PACKOUSKY'S SOLUTION.

Glycerine,	100 parts.
Acetate of soda,	2 "
Carbolic acid,	2 "

Sesemen recommends that the acetate be replaced by arsenite of soda, and 10 parts of water be added.

75. PLATT'S CHLORIDES.

A saturated solution of the chlorides of the metallic salts combined in the following proportion:

Chloride of zinc,	40 per cent.
“ lead,	20 “
“ calcium,	15 “
“ aluminium,	15 “
“ magnesium,	5 “
“ potassium,	5 “

76. INJECTING FLUID.

Chloride of sodium,	4 parts.
Nitrate of potassa,	1 “
White sugar,	2 “
Tepid water,	15 “

Dissolve. Wash out blood vessels with warm water before injection.

77. DUNG'S SOLUTION.

Ferrous sulphate,	5 ounces.
Carbolic acid,	7 “
Water,	1 gallon.

78. SOLUTION RECOMMENDED BY FRENCH CODEX.

Liquefied chloride of zinc,	1 part.
Distilled water,	2 “

Dissolved and filtered. Density, 1.33 at 36° (Baume). A 5 per cent solution injected into the carotid will preserve temporarily.

79. INJECTION FLUID.

Alcohol,	1 gallon.
Corrosive sublimate,	4 ounces.
Chloride of zinc,	1 “
Arsenic,	3 “
Glycerine,	1 quart.

80. BORO-GLYCERIDE.

Ninety-two parts of inodorous glycerine are heated to about 150° C., and to this is added pure boric acid, crystallized twice to free from impurities, steam is driven off by the formation of water, and the mass loses weight.

81. DRAKE'S EMBALMING FLUID. ENGLISH PATENTS, 1877. NO. 1022.

	Pounds.	Ounce.
Nux vomica,		1
Alum,	3	0
Salt,		3
Muriate of ammonia,	1	1
Arsenic.	9	0
Chloride of mercury,	2	0
Camphor,	1	0
Chloride of zinc,		4

The ingredients are to be pulverized separately, mixed together, and dissolved in a liquid (composed of three parts water to 1 part alcohol) in the proportions of $1\frac{1}{2}$ gallons of liquid to every pound of chemicals.

82. DE WESSLEY'S DISINFECTING SOLUTION.

Ferrous chloride,	25 oz.
Ferrous sulphate,	8 oz.
Zinc chloride,	15 oz.
Water	1 gallon.

83. FARWELL'S DISINFECTANT.

Ferrous sulphate,	17 oz.
Carbolic acid,	5 oz.
Water,	1 gallon.

84. SIRET'S DISINFECTANT.

Ferrous sulphate,	20 parts.
Zinc sulphate,	10 "
Tan or oak bark (powdered),	4 "
Oil and tar, of each,	1 "

To deodorize cesspools, privies, etc.

85. MONSELL'S DISINFECTANT.

Ferric sulphate,	50 oz.
Ferric nitrate,	21 oz.
Water,	1 gallon.

86. GIRONDIN DISINFECTANT.

Zinc sulphate,	33 oz.
Copper sulphate,	2 oz.
Calcium sulphate,	1 oz.
Water,	1 gallon.

87. NEW YORK BOARD OF HEALTH.

Zinc sulphate,	8 oz.
Carbolic acid (crude),	1 oz.
Warm water,	3 gallons.

Recommend the above as an excellent disinfectant for the sick room.

88. GEE'S FRAGRANT DISINFECTANT.

Rectified oil of turpentine,	1 part.
Benzine,	7 parts.
Oil of verbena, to each oz.	5 drops.

89. SEELEY'S DISINFECTANT.

Manganese sulphate,	17 oz.
Ferric sulphate,	8 "
Sulphuric acid,	11 "
Hydrochloric acid,	2 "
Water,	1 gallon.

90. UNITED STATES ARMY DISINFECTANT.

Calverts No. 5 carbolic acid,	1 part.
Ferrous sulphate (commercial),	20 parts.
Water, all by weight,	100 "

In cases requiring the most energetic disinfection, ten parts of commercial zinc chloride is to be substituted for the ferrous sulphate.

91. PHOENIX DISINFECTANT.

Clay,	9 oz.
Ferric chloride,	83 grs.
Ferric oxide,	1 oz.
Lime.	$\frac{1}{2}$ "
Carbolic acid,	26 grs.

92. EGYPTIAN DISINFECTANT.

Sand,	11½ oz.
Alumina,	2½ "
Lime,	26 grains.
Carbolic acid,	22 "
Dead oil,	1 oz.

93. SANITAS DISINFECTANT.

Hydrogen peroxide,	
Camphoric acid,	
Turpentine,	p. r. n.

94. FORMULA

Wood alcohol,	2 gal.
Carbolic acid,	5 oz.
Thymo-alcohol,	1 “
or	
Thymol, dissolved in alcohol,	1 oz.
Gum camphor,	5 “
Chloride of zinc or alumina,	5 “
Corrosive sublimate,	2 “
Glycerine or boro glycerine,	2 pints.
Water, to make	5 galls.

After six hours add the glycerine and the water.

95. FORMULA

White arsenic,	10 oz.
Chloride sodium,	20 “
Water (boiling).	3 pints.
Muriatic acid,	50 oz.

And all block zinc that it will take up or dissolve. Or

Alcohol (Methyl will answer),	1½ pints.
Corrosive sublimate,	3 oz.
Salicylic acid,	4 “
Hydrate chloral,	5 “
Thymol,	1 “
Glycerine,	3 pints.

Both of the above are excellent as injecting fluids.

96. CHLORINE DISINFECTANT.

Black oxide of manganese,	9 pounds.
Common salt,	8½ “
Commercial sulphuric acid	15½ “
Water.	36 pints.

To be used in an earthen or lead pan. It should remain in the room from six to eight hours. On closing the doors and windows they should be well sealed. The best way is to paste strips of paper over all of the joints. After the room has been opened it should remain for at least 24 hours with a good current of air running through it. This is sufficient for a room containing 1000 cubic feet.

97. INJECTING FLUID.

Oil of wintergreen,	½ oz.
Glycerine,	1 gal.

Hydrate of chloral,	5 oz.
Thymol,	2 “
Corrosive sublimate,	7 “
Arsenious acid,	4 “
Common salt.	13 “
Hot water,	2 gal.
Alcohol,	2 “

98. COLLINS' DISINFECTING POWDER.

Dry chlorinated lime,	2 parts.
Burnt alum,	1 “

Use either dry or slightly moistened with water.

99. MARTINSON'S MODIFICATION OF WICKERSHEIMER'S FLUID.

Borax,	20 oz.
Potass. sulphate,	8 oz.
“ carbonate,	18½ oz.
Sodic chloride,	10 oz.
“ nitrate,	6 oz.
Arsenious acid,	2 oz.
Glycerine,	28 pints.
Alcohol,	7 pints.
Water,	72 pints.

Dissolve the arsenic and carbonate of potash in a part of the water by heat, and then add the other ingredients dissolved in the rest of the water. Cost, about \$4.00 per gallon and dangerous. A body requires one-half its weight of fluid, and a gallon weighs from eight and one-half to ten pounds.

100. MODIFIED WICKERSHEIMER'S FLUIDS BOTH FOR INJECTION AND IMMERSION.

	For Injection.	This Column for Immersion.	
Arsenious acid,	16 grammes.	12 grammes, or	3 drachms.
Sodic chloride,	80 “	60 “ “	2 oz.
Potass. sulphate,	200 “	150 “ “	5 oz.
Potass. nitrate,	25 “	18 “ “	6 drachms.
Potass. carbonate,	20 “	15 “ “	3½ “
Water,	10 litres,	10 litres, “	20 pints.
Glycerine,	4 “	4 “ “	8 “
Wood Naphtha,	3½ “	8¼ “ “	½ “

101. STRONG DISINFECTANT.

Chloride of lime,	} of each,	2 drachms.
Sulphate of zinc,		

Carbolic acid,	{ of each, 1 drachm.
Oil of eucalyptus,	
Alcohol,	2 oz.

Place the lime and sulphate of zinc in a half-gallon bottle. Mix together the carbolic acid, oil and alcohol, add a quart of water and add to the salts. For ordinary use three ounces of this may be diluted with a quart of water.

102. A CHEAP DISINFECTANT.

Corrosive sublimate,	1 oz.
Common salt,	5 oz.
Warm water,	1 pint.

Half an ounce of the above added to a gallon of water will make an efficient disinfectant.

103. OZONE DISINFECTANT.

Take of commercial sulphuric acid, free of arsenic, a suitable quantity, and place it in an open china vessel, and add gradually one-half or three-fourths of a teaspoonful of crude granulated permanganate of potassium. Brown residue mixed with water makes an excellent disinfectant.

104. DISINFECTANT FOR ALVINE DISCHARGES.

Copper sulphate,	8 oz.
Water,	1 gallon.
Sulphuric acid (commercial),	1 oz.

105. FOR SAME PURPOSE.

Corrosive sublimate,	2 oz.
Muriate of ammonia,	1 oz.
Water,	1 gallon.
Nitro-muriatic acid,	$\frac{1}{2}$ oz.

106. DISINFECTING POWDER.

Corrosive sublimate,	2 parts.
Carbolic acid (crystals),	5 "
Ferrous sulphate (air dried),	100 "

107. G. M. B., DISINFECTANT SOLUTION.

Corrosive sublimate,	1 drachm.
Copper sulphate,	1 ounce.
Water,	1 pint.

108. "SOLUTION NO. 5." (DISINFECTANT.)

Corrosive sublimate,	4 oz.
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Water,	1 gallon.
Permanganate of potassium,	1 drachm.

109. CHEAP DEODORIZER.

(a) Nitrate of lead,	2 oz.
Water,	1 pint.
(b) Chloride of sodium,	8 oz.
Water,	3 pints.

Mix the two solutions, filter and add one pint of the filtrate to 8 gallons of water.

110. SOLUTION OF PERMANGANATE OF POTASSIUM.

Potassium permanganate,	80 grs.
Water,	1 pint.

111. FOR ARTERIAL INJECTION.

Chloride of sodium,	4 parts.
Nitrate of potash,	1 part.
White sugar,	2 parts.
Tepid water,	15 “

112. DICKSON'S FLUID.

Chloral hydrate,	{ of each	10 grs.
Soda sulphate,		
Water,		1 oz.

113. TUCKER'S FLUID.

Arseniate of soda,	10 oz.
Carbolic acid,	8 “
Glycerine,	2 pints.
Water,	5 gallons.

Dissolve the arseniate in the water, and the carbolic acid in the glycerine, and then mix.

114. HEBERT'S INJECTION.

Solution of acetate of alumina, prepared by the decomposition of the sulphate with the acetate of lime, the solution to mark 28 degrees by Baume's hydrometer. To this is added one-twentieth part of arsenic acid before injecting it. *English patents No. 7856.*

115. MOREAU'S INJECTION.

Dissolve metallic zinc in water and sulphuric acid until the solution is of 30 to 40 degrees Baume. Decant and filter, and during injection add one-third part of oil of turpentine. *English patents No. 13,739.*

116. BABOEUF'S PRESERVATIVES.

By the distillation of vegetable substances as peat, wood, etc., an oily tar is first produced, and then this is saponified with caustic soda, to remove the saponifiable part. The supernatant unsaponifiable parts are utilized for preservative purposes by Baboeuf by soaking the substance in it and then exposing to the air, or by fumigation. For the preservation of the body a solution of the alkaline phenates (See phenic acid) of 6 to 15 degrees is used either by immersion or injection.

117. MORGAN'S INJECTION.

Common salt, (Sat. sol.)	$\frac{1}{2}$ gallon.
Nitre,	4 oz.
or	
Saturated solution com. salt,	1 gallon.
Nitre,	1 lb.
Alum,	1 lb.
Arseniate of potash,	1 oz.
Oil of thyme,	$1\frac{1}{2}$ oz.
Oil of wintergreen,	$\frac{1}{2}$ drachm.

English patents, 1863, No. 412.

118. LARNAUDES' PRESERVING FLUID.

Natural water,	100 lbs.
Sulphate zinc,	$26\frac{1}{2}$ lbs.
Sulphate copper,	8 oz.

English patents, 1860, No. 642.

119. AUDIGIER'S POWDER FOR EMBALMING.

Wood dust or powder,	2 lbs., 2 ounces.
Nitric acid at 36 degrees Baume,	2 lbs., 11 ounces.
Marine or bay salt,	$10\frac{1}{2}$ ounces.
Essences of lavender and thyme,	$5\frac{1}{2}$ drachms.

120. AUDIGIER'S LIQUID.

Nitric acid at 40 degrees Baume saturated with salt,	$24\frac{1}{2}$ oz.
Crystallized sulphate of zinc,	7 oz.

This liquid is introduced through the mouth, as described under English patents. *English patents, 1864, No. 926.*

121. LAURENT'S MIXTURE.

Bicarbonate of soda,	60 parts.
Sugar,	40 “

Dissolved in water so as to make a paste.

English patents, 1878, No. 1766.

122.

Dr. Pousino, of Macao, used the following solution for embalming bodies:

Boil in ten gallons of distilled water:

Alum,	1 lb.
Common salt,	8 oz.
Saltpetre,	10 “
Nitrate of potash,	18 “
White arsenic,	8 “
Chloride of zinc,	2 “
Corrosive sublimate,	8 “
Camphor,	8 “
Glycerine,	2 gallons.
Alcohol,	1½ “

That same gentleman recommends also a solution of alum, tannic acid and corrosive sublimate for submersion of the body.

122a. CLARK'S SOLUTION, No. 1.

Make a saturated solution of commercial borax in water, then force into this solution a stream of sulphurous acid gas by means of a pump or otherwise, and continue to force this gas into the solution until it becomes neutral. *English patents 1867, No. 379.*

123. CLARK'S SOLUTION, No. 2.

Dissolve pure crystals of sulphite of soda in water until the specific gravity of said solution will mark from five to thirty-five degrees Baume, and then neutralize said solution with sulphurous acid.

124. BALSAMIC WINE.

Good red wine,	8 pints.
Cloves, roses, citron bark, colocynth, aa.,	2 oz.
Styrax, benzoin, aa.,	1 “

Reduce these drugs to a coarse powder, macerate for a few hours in wine, and boil slightly.

Uses: Lotions for the interior parts of the body; and to disinfect the chamber during the operation.

125. COMPOUND BRANDY.

Absinthe leaves, great centaury, rhue, sage, majory,	
mugwort, thyme, aa.,	4 handfuls.
Colocynth,	2 oz.
Styrax, calamite, benzoin, aa.,	3 “
Pepper, ginger, aa.,	2 “

Macerate in a sand-bath for twenty-four hours, in fifteen pints of best brandy, with as much distilled vinegar.

126. VINEGAR FOR WASHING THE HEAD, THE BREAST, THE BELLY,
AND FOR INJECTIONS.

White and black pepper, ginger, aa.,	$\frac{1}{2}$ lb.
Colocynth,	3 oz.
Absinthe, centaury, hypericum, aa.,	4 “

Reduce to a coarse powder, and macerate in forty pints of rose-vinegar, then strain for use.

127. FORMULA.

Absinthe, five or six handfuls.	
Colocynth apples,	30
Alum, common salt, aa.,	1 lb.
Concentrated vinegar,	14 pints.

Let it boil a little, and add two pints of brandy.

128. CERE-CLOTH.

New wax,	12 lb.
Fluid styrax, oil of turpentine, aa.,	1 “

Melt and mix them over a slow fire, then draw the linen through it frequently so as to impregnate both sides.

129. NAPHEGYI'S PRESERVATIVE.

Hydrate of Methyl,	2 parts.
Oxide of ethyl,	1 “

English patents, 1874, No. 83.

130 MIXTURE FOR SOAKING THE LINENS, THE CHEMISE, THE COIF-
FURE, AND THE BANDAGES.

New wax,	20 pounds
Venice turpentine, gum elemi, of each,	2 “
Powdered Florence iris,	4 “
Styrax, calamite, benzoin, of each,	6 ounces
Myrrh, aloes, of each,	3 “
Balsam of Peru, oil of absinthe,	q. s.

Melt the wax and the gum, add the balsam, and then the powdered aromatics for use.

131 ROBOTOM'S PREPARATION.

Borate of Soda,	5 to 10 parts.
Borate of Lime,	100 “

English patents, 1876, No. 1969.

132. GORGES' PRESERVATIVE POWDER.

Chloride of sodium,	50 parts by weight.
Acetate of soda,	35 " "
Nitrate of potash,	2 " "
Chlorhydric acid,	10 " "

See United States Patent 201,344.

133. INJECTING FLUID.

Arsenic,	4 pounds.
Carbonate of potash,	2 "
Crude carbolic acid,	2 pints.
Glycerine,	2 "
Hot water, to make	1 gallon.

Simmer slowly over a fire until well dissolved.

134. SOLUTION OF CADET.

Arsenic,	8 parts.
Carbolic acid,	12 "
Acetate of soda,	40 "
Glycerine,	40 "
Water,	300 "

135. DR. MEHU'S SOLUTION.

Arsenious acid,	20 grammes.
Carbolic acid (crystals),	20 "
Alcohol,	300 "
Distilled water,	700 "

The arsenic and alcohol preserve; carbolic acid prevents mold.

136.

Chloride sodium,	4 parts.	
Nitrate of potash,	1 "	
White sugar,	2 "	
Tepid water,	15 "	Dissolve.

FORMULA 137. THE EGYPTIAN EMBALMER.

July 23, 1878. Rich J. McGowan assigns to the Egyptian Embalmer the following embalming composition for which letters patent were issued on that date, viz.:

"The composition is prepared by first dissolving three pounds of saltpetre in one gallon of boiling water, then dissolving four ounces of thymol; six ounces of chloride of aluminium, four ounces of salicylic acid, and four ounces of glycerine in one gallon of water, and then adding

about three gallons of water so as to obtain five gallons of the mixture."

United States Patent No. 206,343.

138. M'CARTY'S FLUID.

Sulphate atropia,	6 oz. (!!!)
Boiling alcohol,	1 gal.
Alum,	4 oz.
Saltpetre,	4 oz.

For use when body is discolored and gives off disagreeable odors.

United States Patent, No. 222,521.

139. M'CARTY'S FLUID.

11. After discoloration is removed and odors stopped, the following should be used for arterial injection through the natural openings.

Sulphate of zinc,	4 oz.
Water,	1 gal.

Filter and add salicylic acid, 4 oz. (dissolved in alcohol), extract of white oak bark, $\frac{1}{2}$ gal.

140. CRAFT'S COMPOUND FOR PRESERVING FRUIT.

Biborate of sodium, 10 grains; to be dissolved in one ounce of pure glycerine, at about 200°. together with the same amount of bisulphite of calcium. Then mix this ounce of syrup in a quart of the liquid, or syrup, formed in the usual way for preserving fruit. Heat to 200° and pour over the fruit to be preserved. *United States Patent, No. 224,883.*

141. ARTIMINI'S COMPOUND FOR PRESERVING MEAT.

Tartaric acid, crystallized,	2 parts.
Boric acid,	15 parts.

To be combined by heat to form a boro-tartrate. 12 to 15 parts.

Aromatized water,	1,000 parts.
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To be prepared by immersing bits of nutmeg in distilled water.

United States Patent, No. 228,016.

142. ECKART'S PRESERVATIVE COMPOUND.

Common salt,	50 parts.
Boracic acid (C. P.),	47 $\frac{1}{2}$ "
Tartaric acid,	2 "
Salicylic acid,	$\frac{1}{2}$ "

United States Patent, No. 251,772.

143. CORWIN'S PRESERVATIVE COMPOUND.

Nitrate of potassium, salicylic acid, chloride of sodium, aa., 1 ounce.

Dissolve in one quart of boiling water, then add one drachm of hydrochloric acid, previously diluted with one ounce of water.

United States Patent, No. 253,983.

144. RUDINGER'S FLUID.

Glycerine,	40 parts.
Crystallized carbolic acid,	11 “
Alcohol,	8 “

Use 2 to 4 quarts for each subject, by arterial injection. *Chic. Med. Journal and Ex., July, 1880.*

145. INJECTING FLUID.

Arsenious acid,	5 ounces.
Sodii bicarb.,	$\frac{1}{2}$ drachm.
Aquæ,	1 pint.

146. CLEVELAND PRESERVATIVE FLUID.

Arsenious oxid,	$\frac{1}{2}$ lb.
Hydrochloric acid,	q. s. ad. sol.
Glycerine,	$\frac{1}{2}$ pint.
Proof spirits,	2 pints.
Water, q. s. ad,	1 gal.

Dissolve the arsenic in part of the water by the aid of the acid. Mix and add the spirits and glycerine.

147. INJECTING FLUID.

Crystallized carb. of sodium,	16 oz.
Oxide of arsenic,	12 oz.
Water,	40 oz.

Boil together in a porcelain vessel until all the arsenic is dissolved adding water as it evaporates so as to keep it to the original amount.

148. UNIVERSITY OF VERMONT FORMULA.

Arsenic acid,	$2\frac{1}{2}$ drachms.
Nitrate of potash,	3 “
Chloride of sodium,	$6\frac{1}{2}$ “
Alum,	$3\frac{1}{2}$ oz.
Boiling water,	4 quarts.

Dissolve completely and let stand until cold, filter and add glycerine, 6 pints, methylic alcohol $4\frac{1}{2}$ pints. It requires from $1\frac{1}{2}$ to 5 quarts to properly embalm a body

149. ARSENICAL PRESERVATIVE.

Arsenic, soda bicarbonate aa., 1 lb. Boil in $\frac{1}{2}$ gal. of water one hour and add carbolic acid 4 oz.

150. INJECTING FLUID.

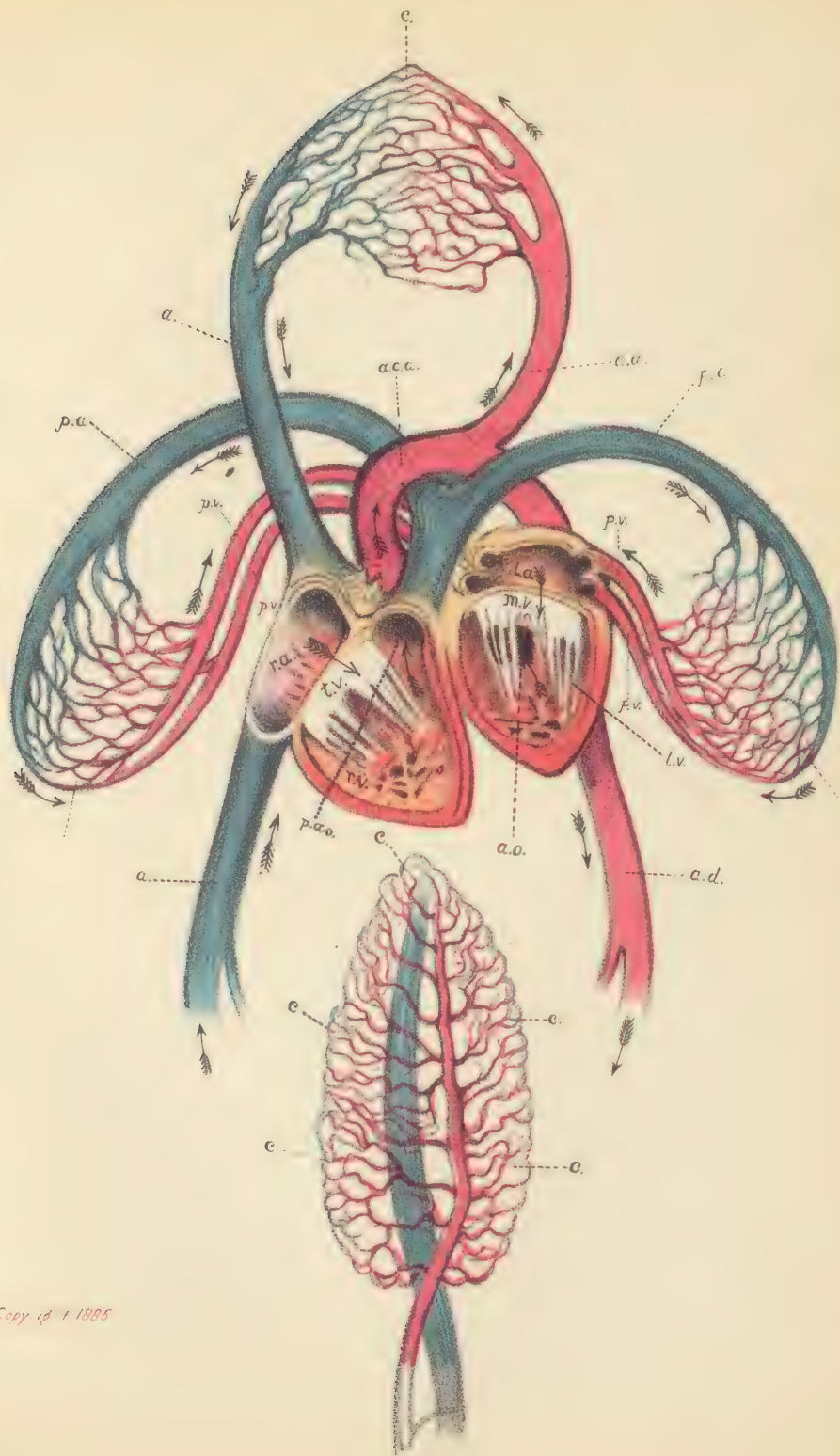
Potass nitrate,	1 lb.
Brown sugar,	3 lb.
Alcohol,	6 oz.
Carbolic acid,	3 oz.
Water,	1 gallon

PLATE VI.

DIAGRAM OF HEART AND CIRCULATION.

- a. a.* Vena Cava—inferior and superior.
r. a. Right auricle, with orifices of the venæ cavæ emptying into it.
t. c. Tricuspid valve, closing orifice between right auricle and ventricle of heart.
r. c. Right ventricle of heart.
p. a. o. Orifice of pulmonary artery.
p. a. Right and left pulmonary arteries.
p. c. Pulmonary veins, arising from the lungs and emptying by four orifices into the left auricle.
l. a. Left auricle.
m. c. Mitral valve, closing orifice between left auricle and left ventricle.
l. c. Left ventricle.
a. o. Aortic orifice.
a. a. a. Arch of the aorta.
a. a. Ascending aorta, communicating by capillaries with the superior vena cava.
a. d. Descending aorta, at last communicating by capillaries with the inferior vena cava, though this communication is not shown in the plate, as in the case of the ascending aorta, the space being taken for a cut showing more in detail the anastomoses between the arterial and venous capillaries, and also the relative size of the artery and vein.
a. Minute artery.
v. Capillary vein.
N. B. The course of the blood is shown by the arrows in the diagram.

PLATE VI.



SECTION VII.

PHARMACEUTICAL, ANATOMICAL, AND CHEMICAL LEXICON.

ALSO A

GLOSSARY OF DISEASES

AND

LIST OF POISONS AND ANTIDOTES.

SECTION VII.

A LEXICON

OF THE

PHARMACEUTICAL, ANATOMICAL AND CHEMICAL TERMS EMPLOYED
IN THE FUNERAL DIRECTOR'S PROFESSION.

A, or AN before a vowel, signifies, when prefixed to a word derived from the Greek language, without, or deprived of, thus asthenia means without strength; anæsthesia denotes a loss of feeling, or sensation.

AA. Signifies when written after two or more substances that they are taken in equal parts by weight or measure; *e. g.*, common salt, nitre aa 5 oz.

AB. In words from the Latin has the same significance as a or an, in words from the Greek.

ABARTICULATION. A joint admitting of extensive motion.

ABBREVIATIONS. Initial letters, or contractions, usually of Latin words, formerly largely used in pharmacy and medicine. Many of these have become obsolete, but those in general use may be found under their appropriate letters.

ABIES. The Latin name for fir, a genus of evergreen tree, several varieties of which produce balsams of value in the preservation of the dead, viz.:

ABIES BALSAMEA. (The American silver fir, or balm of Gilead.) The sap which exudes from its bark

is known as Balsam fir, Canada turpentine, or Canada balsam.

ABIES CANADENSIS (*Pinus Canadensis*, Hemlock Spruce). The species of fir from which Canada pitch is produced.

ABIES EXCELSA. A species of European fir from which Burgundy pitch is obtained.

ABDOMEN is that portion of the human body which lies below the diaphragm and above the pelvic bones and between the lumbar vertebræ and the muscles of the belly. It is theoretically divided into nine regions by imaginary lines. (See page 74.)

ABDOMINAL. Pertaining to the abdomen.

ABDOMINAL CAVITY, strictly speaking, is that contained within the peritoneal sack, excluding the kidneys and pelvic viscera. It is the largest of the three great cavities of the body and is usually spoken of as containing the stomach, liver, spleen, pancreas and kidneys, or all the organs embraced within the belly.

ABDOMINAL PREGNANCY. (See Glossary of Diseases.)

ABDUCTOR (L). The Latin name

given to those muscles whose duty is to draw away from the center or, axis of the body. Some of the more important of these are:

ABDUCTOR OCULI, or the muscle which draws the eyeball from the nose.

ABDUCTOR LABIORUM, or the muscle which draws up the angles of the mouth.

ABDUCTOR INDICIS, the abductor of the index finger.

ABDUCTOR LONGUS POLLICIS, the long abductor of the thumb.

ABDUCTOR INDICIS PEDIS, the abductor of the big toe.

ABLATION. Amputation, and in chemistry the removal of whatever is finished, or no longer necessary.

ABLUTION. A washing often used in the sense of solution.

ABORTIFACIENTS OR ABORTIVES. Medicines used to produce abortion or miscarriage. (See poisons.)

ABRASION. A rubbing or shaving off and hence used to denote a loss of the skin, or mucous membrane by friction or maceration.

ABSCISSION. The cutting off, or away of a part, hence sometime used as a synonym of amputation.

ABSINTHIUM. The common worm-wood (*Artimisia Absinthium*). See poison for Absinthism.

ABSOLUTE ALCOHOL. (See Alcohol.)

ABSOLUTE ZERO. Is that point of temperature at which a gas is supposed to have no elastic force and consequently exerts no pressure and has no molecular motion at all. Theoretically this point ought to be reached at 273 C., or 490 F.

ABSORBENTS. (A) The lacteal and lymphatic vessels which absorb, or take up, the partially digested food, or other substances.

(B) Any medicine which absorbs and thus counteracts irritant and poisonous substances.

(C) In surgery materials, such as sponges, cotton or tow used to

absorb fluids. In medicine, drugs which neutralize alkalinity. (See alkalies.)

ABSORPTION. The act of imbibition or taking up of a liquid by a porous body. Chemically used also to denote the conversion of a gas or vapor into a liquid, or solid by condensation upon some other substance as hydrogen gas by spongy platinum.

ABSTERGENT. Cleansing or carrying away, whence applied to medicine used for this purpose.

ABSTRACT. In the U. S. P. the name is given to milk sugar triturates of an alcoholic extract; each grain of the abstract representing two grains of the crude drug.

ACACIA. A large genus of trees and shrubs, many of which yield valuable gums and other medicinal products, to wit:

A. Catechu. From which gum catechu is obtained.

A. Gummi. Vera, etc., yielding the gum acacia of commerce.

A. Adonsonii. Producing Serre-gat gum, etc., etc.

ACARDIAC. Without a heart.

ACARUS, ACARUS SCABIEL. An insect producing the itch.

ACCELERATOR MUSCLE. One which aids in the expulsion of fluid.

ACCESSORY. Aiding in producing some effect.

ACCOUCHEMENT. Delivery; child birth.

ACEPHALOUS. Headless.

ACENAPTENE. One of the constituents of coal tar.

ACERB. Sour and bitter, like unripe fruit.

ACERIC ACID. An acid obtained from the sugar maple.

ACERRA. A vessel in which incense was burned by the Romans at their burials.

ACESCENT. Liable to become sour or acid.

ACETA. Vinegar, or infusions of medicinal substances in distilled vine-

gar, or dilute acetic acid, which is a good solvent for many of the alkalis, and other vegetable principles.

ACETABULUM. The hemispherical cavity in the hip bone which holds the round head of the femur, or the upper bone of the leg.

ACETAL. A colorless liquid with a pleasant odor, not unlike alcohol, from which it is formed by oxidation by means of platinum black, etc.

ACETATES. The chemical name given to the salts formed by the union of acetic acid with some base. Some of the more important acetates are:

ALUMINA ACETATE. (See Antiseptics.)

AMMONIA ACETATE. *Spirits Mindereri.*

AMYL ACETATE. (See Antiseptics.)

COPPER ACETATE. Crystals of Venus.

LEAD ACETATE. Sugar of Lead.

MORPHIA ACETATE. (See Poisons.)

POTASSA ACETATE. *Potassa Acetata.*

SODA ACETATE. *Sodae Acetas.*

ZINC ACETATE. *Zinci Acetas.*

ACETIC ACID. An acid prepared from vinegar, etc., found in the market either as a colorless, acid liquid, or under the name of glacial acid in ice-like crystals which melt with very little heat (16 C.) and take up sufficient moisture from the atmosphere to deliquesce.

ACETIFICATION. The operation of making vinegar, or turning sour.

ACETIMETRE. An instrument for determining the amount of acetic acid contained in vinegar.

ACETONE. A colorless, inflammable liquid sp. gr. o. 792, sometimes known as pyro-acetic ether.

ACETOUS, or ACETOSE. Sour, acid.

ACETUM. Vinegar, which see.

ACETYLENE. An exceedingly

poisonous, colorless gas, with a disagreeable odor which it imparts to ordinary gas, of which it is one of the constituents. (See Poisons.)

ACHILLES TENDO (The tendon of Achilles). The large tendon just above the heel. Name from Achilles from the fable that there was the only place where he could be wounded.

ACHOR. A small pustule which suppurates.

ACICULA. Shaped like a needle.

ACID. Popularly denotes any substance with a sour taste. Chemically an acid is a compound containing replacable hydrogen united to an electro-negative element by oxygen. (See Chemistry, p. 127.)

Some of the more important acids are:—

ARSENIC ACID. (See Poisons.)

ARSENIOUS ACID. White Arsenic. (See Poisons.)

BENZOIC ACID. Prepared from Gum Benzoin.

CARBOLIC ACID. (See Antiseptics.)

CHROMIC ACID. (See Antiseptics.)

CITRIC ACID. (See Citrates.)

CYANIC ACID. (See Cyanates.)

GLACIAL PHOSPHORIC ACID. (See Phosphates.)

HYDROCYANIC ACID. (See Poisons.)

HYDIOIC ACID. (See Iodides.)

HYDROCHLORIC ACID. (See Chlorides.)

LACTIC ACID. (See Chemistry of Body.)

MARGARIC ACID. (See Chemistry of Body.)

MURIATIC ACID. (See Poisons.)

NITRIC ACID. (See Poisons.)

NITRO-HYDROCHLORIC ACID. (See Poisons.)

PALMITIC ACID. (See Chemistry of Body.)

PARALACTIC ACID. (See Chemistry of Body.)

PHOSPHORIC ACID. (See Phosphates.)

PYROLIGNEOUS ACID. (See Antiseptics.)

STEARIC ACID. (See Chemistry of Body.)

SUCCINIC ACID. (See Chemistry of Body.)

SULPHURIC ACID. (See Poisons.)

SULPHUROUS ACID. (See Antiseptics.)

TANNIC ACID. (See Antiseptics.)

TARTARIC ACID. (See Tartrates.)

TAUROCHOLIC ACID. (See Chemistry of Body.)

URIC ACID. (See Chemistry of Body.)

VALERIANIC ACID. (See Chemistry of Body, etc., etc.)

ACIDITY. Able to be turned into acid.

ACIDIFIER. That necessary to make an acid.

ACIDIFY. To make acid.

ACIDIMETER. An instrument for ascertaining, or for estimating the strength of acids.

ACIDIFIABLE. The quality of being sour.

ACIDUALE. Medicinal springs impregnated with acid.

ACIDULATE. To make acid.

ACIDULOUS. Slightly sour.

ACME. (G.) The height of a disease.

ACNE. Pimples appearing on the face.

ACONITINA. The alkaloid of Aconite. (See Poisons.)

ACONITE. (See Poisons.)

ACOUSTICS. The science of sound.

ACRASY. The predominance of one quality above another in a mixture.

ACRID. Pungent, sour, biting.

ACRIMONY. That quality which dissolves or destroys.

ACROLEIN. A colorless, suffocating liquid obtained by the action of heat on glycerine.

ACRYLIC ACID. An acid produced by the oxidation of acrolein.

ACROMIAL. Belonging to the acromian.

ACROMIAN. The top of the shoulder.

ACTINISM. The property of the sun's rays to produce chemical changes.

ACTIVE PRINCIPLE. Chemically is that portion of a vegetable drug that may be extracted from it and substituted pharmaceutically for the crude drug.

ACTUAL CAUTERY. The use of a red hot iron in treatment of disease.

ACUMINATED. Pointed like a needle.

ACUPUNCTURE. Treatment of diseases by the use of fine needles inserted in the diseased parts.

ACUTENESS. The violence of the disease which brings it to a crisis.

ADAM'S APPLE. The thyroid cartilage of the larynx or the most prominent part of the throat.

ADAPTER. A glass tube open at both ends placed between a retort and a receiver.

ADCORPORATE. To unite one body with another.

ADDENDUM. (L.) Something to be added.

ADEPS. Lard. (See *Azungia*.)

ADDUCTOR. A muscle which draws the parts toward the axis of the body. *e. g.*, *adductor pollicis*, or the adductor of the thumb, or great toe; the *adductor magnus*, or the great adductor of the thigh; the *adductor brevis*, etc.

ADEN. (G.) A gland.

ADENITIS. (See Glossary of Diseases.)

ADENALGIA. (See Diseases.)

ADENOGRAPHY. Description of glands.

ADENO-MENINGEAL. Affecting the glands and mucus membrane.

ADENINE. A new base discovered in 1885 by Kossel in the spleen and pancreas. It is also present in all vegetable and animal cells. Probably a decomposition product of cell nuclei, and, according to the discov-

erer, is very poisonous, showing itself chiefly by its effects upon the medulla oblongata. (See Poisons.)

AD FINEM. (L.) To the end.

ADHESION. The union of parts.

ADHESIVE. Sticky, tenacious.

AD INFINITUM. (L.) To an endless extent.

AD INTERIM. (L.) In the meantime.

ADIPOCERE. A soft, waxy substance of a light brown color, resembling spermaceti, into which dead bodies may be converted by long immersion in water or diluted alcohol, or by burial in moist places under peculiar circumstances. First discovered by Fourcroy in a Parisian burying-ground in 1781. (See Chemistry of Body.)

ADIPOSE. Fat. (See Adipose Tissue.)

ADIPSON. (G.) A medicine which relieves thirst.

ADJUVANT. A substance added to a prescription to assist the effects of the more important drug.

AD LIBITUM. At pleasure.

ADMIXTURE. Is used in chemistry to denote simply a mechanical mixture of different substances. It differs from chemical combination in that a chemical compound differs from its constituents, while admixture does not alter the nature of the substance mixed.

ADRAGANTH. (See Tragacanth.)

ADOLESCENCE. Youth verging on to manhood.

ADVENTITIOUS. Accidental.

ADULTERATION. Making impure by the mixture with base or cheaper materials.

ADYNAMIC. Without strength or vitality.

ÆGOPHONY. (G.) A diseased sound from the lung somewhat resembling the bleating of a goat, whence its name.

AERATE. To impregnate with air or gas.

AERATED. Impregnated with some

gas, usually carbon dioxide, as are the aerated mineral waters.

AERIAL. Pertaining to the air, or atmosphere.

AERIFORM. Similar to air, or gas.

AEROMETER. An instrument for measuring the bulk of gases.

ÆRUGINOUS. Resembling verdigris, or the rust upon copper.

ÆSCLEPIADES. Were the followers of Æsculapius and claimed to have inherited from him his secret medical knowledge. The members of this caste were bound by an oath not to reveal the secrets of their profession.

ÆSCULAPIUS. In Homer, spoken of only as a skilled physician, but in later legends becomes the god or patron of medicine.

ÆSTHETICA. Diseases affecting the sensation.

ÆTAS, or AET. (L.) Age.

ETHER. ÆTHERA. (See Ether.)

ÆTHERIAL. Aeriform, or like an ether.

ÆTHERIZATION. The administration of ether or some other stupefying vapor.

ÆTIOLOGY, or ETIOLOGY. The science of the causes of disease.

ÆTHIOPS MINERAL. Mercury triturated with sulphur until it assumes a black color from its conversion into a sulphide.

ÆTHIOPS, VEGETABILIS. Vegetable ethiopes; the name given to charcoal obtained by the heating of seaweed in a cold vessel.

AFFERENT. Carrying toward; applied to lymphatics carrying the lymph to the glands, also nerves which convey impressions to the brain.

AFFECTUS. A disease or passion.

AFFINITY. The tendency of different forms of matter to unite. (See Chemical Affinity, or Chemism.)

AFFUSE. To pour upon, to sprinkle, as with a liquid.

AFFLUX. The act of flowing to; the congestion of a part with blood.

AFTER PAINS. Pains occurring

soon after delivery, due to irregular contractions of the womb.

AGENESIS. The imperfect development of any part of the body.

AGGLUTINANT. Any adhesive material used to unite substances together.

AGGLUTINATE. To stick together.

AGGLUTITION. Inability to swallow.

AGUE. A chill, or the cold stage of an intermittent fever.

AGUE CAKE. The popular name for the enlarged spleen of chronic malaria.

AGUE DROP. (See Fowler's Solution.)

AGUE TREE. The name formerly applied to the sassafras tree from its supposed value in ague.

AIR-SLAKED. Lime or other hygroscopic substances that gather moisture from exposure to the air, after awhile crumble, and are then said to be air-slaked.

AKASGIA. The name of a vegetable ordeal poison, from which many people perish yearly in Africa. Its composition is unknown, but its action very closely resembles nux vomica, which see.

ALA. (Pl. Alæ.) (L.) A wing, hence often applied by anatomists to projecting parts, as the alæ of the nose, or the alæ of the vomer.

ALANTOIN. A starchy substance, identical with inulin.

ALARIS. (L.) Wing shaped.

ALABASTER. A semi-transparent variety of gypsum, usually white, but sometimes yellow, red or gray.

ALBESCENT. Becoming white.

ALBINO. A person who is destitute of color in the eyes, skin and hair. (See *Leucoderma*.)

ALBUGENITIS. An inflammation of the white tissues.

ALBUGINEOUS. A term applied to tissues and textures which are white as the albugineous tunic of the eye. (*Albuginea Oculi*.)

ALBUGO. A white spot in the eye.

ALBUMEN or ALBUMIN. So named from its property of turning white when heated to coagulation. One of the most important constituents of all organized matter, whether animal or vegetable. It is seen nearly pure in the white of an egg. (See *Constituents of the Body*.) Vegetable albumen is identical with animal albumen, and is found in many vegetable juices, from which it may be separated by heat, nitric acid, or the soluble salts of mercury, copper or zinc. It is a very unstable compound, containing carbon, hydrogen, nitrogen, oxygen and sulphur.

ALBUMINATES. Are organic compounds in which albumen is combined with some base. (For the albuminates, see corrosive sublimate, copper, aluminium and zinc chlorides.)

ALBUMINOIDS. Are chemical compounds so named because of their close resemblance to albumen. (See *Constituents of the Human Body*.)

ALBUMENOSE. Partially digested albumen. (See *Peptone*.)

ALBUMINURIA. Albuminous urine. (See *Bright's Disease*.)

ALBURNUM. The white or sap wood of a tree.

ALCAHEST. A pretended universal solvent, long sought for by the Alchemists.

ALCANIN. An active principle extracted from alkanet by petroleum ether.

ALCHEMISTS. The earliest chemists, whose aim was to transmute the baser metals into gold.

ALCHEMY. The science cultivated by the Alchemist.

ALCOHOL. Rectified spirits of wine. (See *Antiseptics*.)

ABSOLUTE ALCOHOL. Alcohol absolutely free from water.

AMYL ALCOHOL. Fusel oil. (See *Poisons*.)

DILUTE ALCOHOL. Alcohol mixed with equal parts of water.

METHYL ALCOHOL. (See Wood Spirit—Antiseptics.)

OFFICIAL ALCOHOL. Has a specific gravity of 0.835 to 0.838.

These are the more important varieties of alcohol, but there are known to chemistry a very large number of organic compounds to which has been given the name of

ALCOHOLS, or carbon compounds containing hydrogen, oxygen, and a positive organic base. Many of these are dense liquids, like glycerine, which is really, chemically an alcohol, or even solid bodies, and are totally unlike in all other properties the popular idea of an alcohol.

ALCOHOLATES. Salts formed from the alcohols by a substitution of a base for a part of their hydrogen.

ALCOHOLIC FERMENTATION. The change whereby a solution of sugar is changed into dilute alcohol. (See Fermentation.)

ALCOHOLIC POTASSA. Caustic potash is so called, when it has been prepared by dissolving it in alcohol to free it from impurities, and then recovering the potassa by evaporating off the alcohol.

ALCOHOLMETRE. An instrument designed to estimate the proportion of alcohol contained in any liquor. It was invented by Gay Lussac, and contains a scale containing 100 unequal parts; 0 represents pure water, and 100 absolute alcohol. A similar instrument designed by Tralles is used by the U. S. Government.

ALDEHYDES. Literally dehydrogenated alcohols from which they are formed by the abstraction of two atoms of hydrogen. Theoretically there are as many aldehydes as alcohols. Ordinary or acetic aldehyde is a colorless, volatile, very acrid liquid from which is formed *aldehyde resin*, a brownish, gummy substance, by the action of potassic hydrate.

ALE. A malt liquor, differing from beer chiefly in having a smaller proportion of hops. Its color depends

upon the amount of roasting given its malt.

ALEGAR. Sour ale; vinegar made from ale.

ALEMBIC. A vessel formerly used for distillation but now generally replaced by the retort and worm-still.

ALEMBROTH. The name formerly given to a compound of corrosive sublimate and muriate of ammonia.

ALETRINE. The proximate principle of aletris, or star grass.

ALEXIPHARMIC. A medicine designed to act as an antidote to poison.

ALEXITERIC. Resisting poison.

ALGAROBIA. A tree producing mesquite gum which closely resembles gum arabic in many of its properties.

ALGAROTH or ALGAROT. An insoluble oxychloride of antimony, made by pouring water into a strongly acid solution of the chloride. It receives its name of powder of Algaroth from a physician of Verona who discovered it. Emetic and poisonous. (See Antimony.)

ALIENATIO MENTIS. (L.) (See Insanity.)

ALIFORM. Wing like.

ALIMENT. Nourishment; any kind of food.

ALIMENTARY CANAL. The entire passage through which the food passes from its entrance into the mouth until it is rejected from the body. (See plate No. 2.)

ALIZAPURPURIN. A purple coloring matter.

ALIZARIN. A dye obtained both from madder and artificially prepared from anthracene, a coal-tar product.

ALKALEScent. Slightly alkaline.

ALKALI. Any chemical compound which will turn red litmus blue and neutralize an acid to form a salt. Volatile alkali is ammonia gas.

ALKALI ALBUMINATE. (See Decomposition Products.)

ALKALIMETER. An instrument designed to estimate the strength of an alkali, usually for potash, soda or ammonia.

ALKALIMETRY. The estimation of the strength of alkalies.

ALKALINE. Possessing the properties of an alkali.

ALKALOID. Like an alkali. Applied in chemistry to a group of nitrogenous substances obtained from the vegetable kingdom, which possess an alkaline reaction, and combine like them with acids to form salts, such as quinine sulphate.

ALKANET PAPER is that soaked in a tincture of alkanet root, and is used like litmus paper.

ALLANTOIC ACID. An acid extracted from the liquid surrounding the fetal calf. (See Ammiotic Acid.)

ALLANTOIN. A crystalline product of oxidation of uric acid.

ALLANTOIS. A sack found in the fetal quadruped between the tail and bladder.

ALLIACEOUS. Resembling *allium*, or garlic.

ALLOTROPISM. A term used in chemistry to denote the existence of the same chemical compounds under different forms, *e. g.*, a diamond, charcoal, and lamp black are all allotropic conditions of carbon.

ALLOXAN. An oxidation product of uric acid. (See Chemistry of the Body.)

ALLOYS. Any combination of metals which when fused together give a compound differing from its ingredients. The more important of these alloys are given below :

Aluminum bronze,	Copper and aluminum.
Bell metal,	Copper and tin.
Bronze,	Copper and tin.
Gun metal,	Copper and tin.
Speculum metal,	Copper and tin.
Brass,	Copper and zinc.
Dutch gold,	Copper and zinc.
Mosaic gold,	Copper and zinc.
Ormolu,	Copper and zinc.
Toinbac,	Copper and zinc.

German silver, Copper, nickel, and zinc.

Packfong, Copper and arsenic.

Britannia metal, Tin and antimony.

Solder, Tin and lead.

Pewter, Tin and lead.

Fusible metal, Bismuth, lead, tin, and cadmium.

Type metal, Lead and antimony, and sometimes a little copper.

Stereotype metal, Lead, antimony, and bismuth.

Shot metal, Lead and arsenic.

Standard gold, Gold and copper.

Standard silver, Silver and copper.

ALLSPICE. Pimento berries.

ALLYIL. An organic radical obtained from oil of garlic, where it exists in the form of its sulphide (C_3H_5S).

ALLYLENE. (C_3H_4). A colorless gas, with an unpleasant odor.

ALLYLIC ALCOHOL. A colorless liquid, obtained by the reaction of glycerine and oxalic acid.

ALMOND. For toxicology see Oil of Bitter Almonds, under Poisons.

ALMUG. Supposed to be sandal wood, mentioned in the Scriptures.

ALNUIN. The active principle of tag alder.

ALOES. (See Antiseptics and Disinfectants.)

ALOETIC. Pertaining to aloes.

ALOIN. A crystallizable, active principle of aloes.

ALOISOL. An oily liquid, obtained by the distillation of aloes with caustic lime.

ALOPECIA. (G.) Baldness.

ALPHANIX. A kind of sugar-candy used for colds.

ALPINIA CARDAMOMUM. (*Elettaria Cardamomum*.) The cardamom plant.

ALQUIFOU. A sort of lead ore (galena) which, when broken, resembles sulphuret of antimony. It is used by potters to give a green varnish to their wares, and is called potters' ore.

ALSTONIA SCHOLARIS. A possible substitute for gutta percha, found in

the concrete juice of an *Apocynum* growing in Ceylon.

ALTERATIVE. A medicine which gradually induces a change in the constitution, and restores healthy functions.

ALTHEA (Marshmallow.) A genus of plants. The root of one species contains considerable starch, sugar and mucilage.

ALTHEUS. A physician.

ALUDEL. Earthen pots without bottoms, used in sublimations.

ALUM. (Sulphate of alumina and potassa.) A transparent, colorless salt, crystallizing in octahedrons, with an astringent taste. Rarely found pure in nature.

ALUM SHEET. A common sheet soaked in a saturated solution of alum, used to wrap the body in the process of cremation.

ALUMINA. An earth obtainable by calcining ammonia-alum. It contains two equivalents of aluminium and three of oxygen.

ALUMINITE. (Sulphate of alumina.) A yellowish white mineral, found in soil containing chalk.

ALUMINIUM. A white, malleable, ductile, elastic metal, discovered in 1827.

ALUMINIZED CHARCOAL. A substitute for purified animal charcoal, obtained by combining alumina with wood charcoal.

ALUMINOUS. Containing alum.

ALUSIA. (L.) Illusion; hallucination.

ALVEARIUM. (L.) Outer opening of the ear.

ALVEOLAR. Name applied to vessels belonging to the sockets of the teeth.

ALVEOLUS. (L.) The bony socket of the teeth.

ALVINE. Pertaining to the entrails.

AMADOU. (German Tinder.) A fungous, very inflammable growth, found on old trees, and used as tinder.

AMALGAM. Mercury combined with any other metal.

AMALGAMATION. Name of a process of obtaining gold and silver from ores by the aid of mercury.

AMANITINE. The poisonous principle of certain fungi.

AMARANTH. A color inclining to purple.

AMARANTHUS. A genus of plants containing many species.

AMARUS. Bitter.

AMAUCOSIS. (L.) Paralysis of the optic nerve.

AMBER. A hard, bituminous substance of yellowish color, said to be a fossil resin of vegetable origin. It is found in sands and clays of lower tertiary formation.

AMBERGRIS. An ash-colored, waxy substance, of very strong fragrant odor, found floating upon the surface of the sea. There are many theories as to its origin, one being that it is a morbid secretion of the sperm whale.

AMBIDEXTER. Using either hand with equal skill.

AMBLOSIS. An abortion.

AMBLYOPIA. Feebleness of vision.

AMBREADA. A kind of artificial amber.

AMBREATE. A salt formed by the combination of ambreic acid with a base.

AMBREIC ACID. An acid formed by digesting ambreine in nitric acid.

AMBREINE. One of the animal proximate principles, and the chief constituent of ambergris.

AMBROSIA. A genus of plants.

AMBROSIAL. Fragrant.

AMBULATORY. { Wandering.

AMBULANT. }

AMELANCHIER. A plant from which the constituent of bitter almond may be derived.

AMENORRHEA. Absence of menses.

AMERICAN ALOE. (See Agave.)

AMENTIA. (L.) Idiocy.

AMIANTHOID. A variety of asbestos.

AMIDES. Compound ammonias in which 1, 2 or 3 of the hydrogen atoms are replaced by an acid radical. Ammonias in which one or more atoms of hydrogen are replaced by base radicals are called *Amines*.

AMIDINE. Starch modified by heat so as to form a horn-like soluble mass.

AMIDO-CHLORIDE OF MERCURY. (See Ammoniated Mercury.)

AMIDO-VALERIANIC ACID. An acid formed by the action of silver on bromo-valerianic acid.

AMIDOGEN. A basic principle composed of two equivalents of hydrogen and one of nitrogen.

AMINES. (See Amides.)

AMMONIA. A gas obtained from slaked lime heated with sal-ammonica. See p. 220.

AMMONIAC. (*Ammoniacum*.) A yellow nauseous gum-resin obtained from Persia.

AMMONIÆ AQUA. An aqueous solution of ammonia gas.

AMMONIOMETRE. An instrument for determining the strength of ammonia.

AMMONIATED COPPER. A salt, used medicinally as a tonic, obtained by triturating together sulphate of copper and carbonate of ammonia.

AMMONIATED MERCURY. A preparation formed by precipitation of a solution of corrosive sublimate by ammonia.

AMMONIUM. A quasi-metal which can be substituted for potassium or sodium in the alkali salts, forming *ammonium* salts.

AMNESIA. Loss of memory.

AMNION. (G.) The inner envelope of the fetus in the uterus.

AMNIOTIC ACID. An acid found in the amniotic fluids.

AMNIOTIC FLUID. (*Liquor amnii*.) Water surrounding the fetus in the uterus.

AMNITIS. Inflammation of the amnion.

AMOMUM. A genus of plants possessing pungent and aromatic properties.

AMORPHOUS. Irregular; non-crystalline; shapeless.

AMPELITE. An earth abounding in pyrites, used anciently to kill insects on vines.

AMPELOPSIS. Name for the American ivy.

AMPHI. A prefix signifying around; on both sides.

AMPHIARTHROSIS. A mixed articulation, allowing but slight motion.

AMPHIDE. A term applied to compounds consisting of acids and bases, as distinguished from *haloid* compounds.

AMPHIDEXIUS. (L.) Ambidexter.

AMPHIHEXAHEDRAL. Crystals whose faces counted in two different directions give two hexahedral outlines, or are six in number.

AMPHORIC. A term used in describing a sound like blowing into a jar

AMPULLA. (L.) A bottle; a receiver.

AMPUTATION. The cutting off a limb or other part of the body.

AMULETS. Charms found in Egyptian tombs, are idols in gold, bronze, varnished terra-cotta, and wood, gilded or painted.

AMYGDALA AMARA. (See Almonds, Bitter.)

AMYGDALATE. A salt containing amygdalic acid.

AMYGDALIC ACID. The acid obtained from amygdalin.

AMYGDALIN. A crystalline substance obtained from the kernel of the bitter almond.

AMYGDALUS. The plant yielding the sweet almond.

AMYL. A radical consisting of ten parts of carbon and eleven of hydrogen.

AMYLACEOUS. Starch-like.

AMYLEN. A volatile, colorless oily liquid obtained from distilling potato-oil. The vapor has been used as an anæsthetic.

AMYLIN. The tegumentary portion of starch. It is, when entirely freed from the interior soluble matter, wholly insoluble in water and alcohol.

AMYLUM. A principle of the seed of the *Triticum vulgare*. It is inodorous, insipid, white and friable. Found in various grains, plants and roots.

AMYRIS. A genus of trees producing a resinous juice.

AMYOS. (G.) Deficient in muscular strength.

ANACARDIC ACID. An acid obtained from the juice of the cashew-nut.

ANACARDIUM. The cashew tree, yielding a caustic oil, used for destroying warts, etc.

ANACARTHARIC. Expectorant.

ANÆMIA. (G.) Lack of blood.

ANÆMIC. Pertaining to anæmia.

ANÆROBIC. Existing without air or oxygen. (See Bacteriology.)

ANÆSTHESIA. Insensibility produced by chloroform or other agents.

ANÆSTHETIC. Causing insensibility by inhalation.

ANAGALLIS ARVENSIS. (L.) A plant producing a volatile oil which causes headache.

ANAGRAPH. A prescription.

ANAL. Pertaining to the anus.

ANALEPTIC. Restorative.

ANALGESIA. } Lack of pain.

ANALGIA. }

ANALOGUE. A counterpart.

ANALOGOUS. Closely similar.

ANALYSIS. The separation of a compound body into its constituent parts.

QUALITATIVE ANALYSIS. The determination simply of the ingredients present.

QUANTITATIVE ANALYSIS. The determination of the proportions of the ingredients or constituents.

ANAMIRTA COCCULUS. A climbing shrub with a corky bark, producing poisonous and intoxicating berries.

ANANAS. The pine-apple.

ANANDRIA. (G.) Lack of manhood.

ANAPHIA. (G.) Loss of the sense of touch.

ANAPHRODISIA. (G.) Impotency.

ANAPHRODISIAC. A medicine blunting sexual appetite.

ANAPLEROTIC. An application causing granulation of wounds or ulcers.

ANAPLASIS. (G.) Restoration.

ANAPLASTIC. Surgical art of transplanting skin.

ANAPLOSIS. (G.) Growth.

ANAPNOE. (G.) Respiration.

ANARCOTINA. A term applied to narcotina, denoting its small narcotic power.

ANARTHROS. (G.) Jointless.

ANASARCA. Dropsy of the cellular tissue.

ANASTALTIC. An energetic stiptic or astringent.

ANASTOMOSIS. (G.) Communication between two vessels. (See Inoculation.)

ANATOMY. (From *anatemno*, to cut apart.) Literally, a dissection, or the science whose object is the examination of the structure, relation and uses of the parts of the human body, or those of the lower animals.

Pathological anatomy is the study of the changes produced in the organs and tissues by disease.

ANATRON. Soda.

ANATROPE. Turning.

ANCHYLOBLEPHARON. (G.) Adhesion of the eyelids.

ANCHYLOSIS. An impossibility of movement in a natural articulation.

ANCON. (L.) The elbow-joint.

ANCONÆUS. Small muscle on the elbow.

ANCONOID. A process upon the ulna.

ANDA BRASILIENSIS. (L.) A tree

of Brazil which yields a poisonous milky juice.

ANDARIC. Red orpiment.

ANDIRA INERMIS. (L.) A leguminous tree of the West Indies.

ANDRIA. (G.) Manhood.

ANDRIA MULIER. Hermaphrodite.

ANDROMEDA. A genus of plants.

ANDROTOMY. Human anatomy.

ANDROGYNUS. An hermaphrodite.

ANEMOS. (G.) The wind.

ANENCEPHALUS. (G.) A monster born without brains.

ANENERGIA. (G.) Debility.

ANER. (G.) A man.

ANEROBIC. (See Anærobic.)

ANESIS. (G.) Remission.

ANETHOL. A name for the solid and liquid oils of anise. A hydrocarbon.

ANETICUS. (L.) Anodyne.

ANETUS. Intermittent fever.

ANEURISM. An abnormal dilation of an artery and rupture of its coating.

ANEURISM CORDIS. Dilation of the heart.

ANEURISM SPURIUM. A rupture of all the coats of the artery.

ANFRACTUOSITY. A groove or furrow.

ANGIOLOGY. Science of the vascular system.

ANGELIC ACID. A fatty acid obtained from croton oil.

ANGELICIN. A crystallizable substance obtained from the root of the *Angelica archangelica*.

ANGINA. (L.) An inflammatory affection of the throat.

ANGINA PECTORIS. (L.) A disease of the nerves of the heart.

ANGINOSA. (L.) Accompanied with angina.

ANGOLA WEED. Species of lichens producing litmus.

ANGONE. Nervous quinsy.

ANGRÆCUM FRAGRANS. An orchideous plant, native of the Isle of Bourbon, the leaves of which have

long been used under the name of *Falium*, for the same purposes as Chinese tea. They have a strong agreeable odor.

ANGSANA, } A red gum of the
ANGSAVA. } East Indies, resembling Dragon's blood.

ANGUSTURA. The bark of *Galipea officinalis* or *G. cusparia*, a small tree, the bark of which is considered a stimulant tonic, and, in large doses, emetic and cathartic.

ANHELATION. Short and rapid breathing.

ANHISTOUS. Without organic texture.

ANHYDRITE. Without water,—referring to mineral compounds.

ANHYDRUS. Without water.

ANIL. A shrub from whose leaves and stalks indigo is made; a species of indigo fern or indigo plant.

ANILINA. (*Phenylamina*, *Phenamide*.) An artificial alkaloid prepared on a small scale from nitrobenzole, iron filings, and strong acetic acid. It is a colorless oil, of vinous odor and aromatic taste. Combined with sulphuric acid it forms the medicinal sulphate.

ANILINE, } A base, analogous
ANILIN, } to ammonia, and con-
ANILIA, } sisting of twelve parts

of carbon, seven of hydrogen, and one of nitrogen. It is produced by indigo, coal tar, and other substances, on distillation, and affords a deep violet-blue color with chloride of lime or by reaction with bicarbonate of potassa.

ANIMAL ALKALI. Ammonia.

ANIMAL CHARCOAL. (See Bone Black.)

ANIMAL HEAT. Caloric formed by breathing oxygen. (See Chemistry of the Human Body.)

ANIMALCULA. (*Plural*, *animalculæ*.) An insect invisible to the naked eye.

ANIME. A resin used for varnish, and also as incense.

ANIMUS. (L.) The principle of life.

ANINGA. A root growing in the West Indies, used in refining sugar.

ANISATUM. A wine made with honey and anise seed.

ANISE. The seed of the *Pimpinella anisum*, possessed of a piquant taste, slightly sweet. The best comes from Malta and Alicante.

ANISE CAMPHOR. An oil contained in oil of anise. Called also stearoptene.

ANISETTE. A cordial flavored with anise-seed.

ANISIC ACID. An acid formed by the oxidation of anise oil by nitric or chromic acid.

ANKLE. The malleolus, a joint connecting the foot with the leg.

ANAKYLOSIS. (G.) A stiff joint.

ANNOTTO. A yellow coloring substance obtained from the Bixa tree. It is used in dyeing.

ANNUAL. A plant whose life is comprised within one year.

ANNULAR. Ringlike.

ANO. A prefix, meaning *above*.

ANODIC. Tending upward.

ANODYNE. A drug benumbing the sensibilities and inducing sleep.

ANODYNIA. (L.) Absence of pain.

ANOINT. To smear or rub over with oily substances.

ANOMALOUS. Irregular.

ANOMALY. Irregularity.

ANOMESIA. (L.) Loss of mind.

ANOMPHALOUS. Without a navel.

ANTALKALI. A medicine for neutralizing an alkaline tendency.

ANTAGONIST. A term applied to counteracting muscles.

ANTAPOPLEPTIC. A remedy for apoplexy.

ANTAPHRODISIAC. Medicines which blunt the sexual appetite.

ANTARTHRITIC. A remedy for gout.

ANTASTHMATIC. A remedy for asthma.

ATEMETIC. A remedy for nausea.

ANTEBRACHIAL. Relating to the forearm.

ANTELABIA. Extremity of the lips.

ANTENNARIA MARGARITACEA. The plant commonly called "Everlasting." The leaves are used medicinally.

ANTERIOR. Before; situated in front.

ANTEVERSION OF THE UTERUS. Inclining forward of that organ.

ANTHELMINTIC. A worm-destroyer.

ANTHEMIC ACID. An acid obtained from *Anthemis arvensis*.

ANTHEMIS. The chamomile.

ANTHORISNA. An indefinitely extended tumor.

ANTHOXANTHUM ODORATUM. A plant which yields an odorous principle identical with the *coumarin* of the tonka bean.

ANTHRACENE. A colorless, insoluble solid obtained from the distillation of coal.

ANTHRACITE. A hard, compact variety of coal.

ANTHRAKOKALI. A preparation formed by adding 160 parts porphyzied mineral coal to 192 parts of a concentrated and boiling solution of caustic potassa contained in an iron vessel, the whole stirred together. When completed it is taken from the fire, and the stirring continued until the whole is converted into a homogeneous black powder.

ANTHRANILIC ACID. An acid formed by the action of bromine on benzoic acid. It is identical with amido-benzoic acid.

ANTHRACOTYPHUS. The black plague.

ANTHRACOSIS. Carbuncle of the eyelids.

ANTHRAX. Carbuncle.

ANTHRENUUS. Parasitic animals living upon the Spanish fly.

ANTHROPOLOGY. The science of man, considered in his entire nature.

ANTHROPOPHAGUS. (G.) A cannibal.

ANTHROPOMAGNETISMUS. Animal magnetism.

ANTHROPOSCOPIA. Physiognomy.

ANTHYPNOTIC. A remedy for sleeplessness.

ANTI. A prefix, denoting *against*.

ANTIAR. (*Upas Antiar*.) A poison used by the natives of the East India islands for poisoning their arrows. Its active ingredient is a gum-resinous exudation, proceeding from incisions in the trunk of the *Antiaris toxicaria*.

ANTIARIN. The poisonous principle of Antiar.

ANTIARTHRITIC. A remedy for diseases of the joints.

ANTIATTRITION. A lubricant, consisting of plumbago combined with some oily substance, designed to counteract friction in machinery.

ANTIBRACHIAL. Relating to the fore-arm.

ANTIBILIOUS. A remedy for biliousness.

ANTIBROMIC. A remedy for offensive odors.

ANTICACHETIC. A medicine tending to correct an ill-habit of the body.

ANTICARDUM. The pit of the stomach.

ANTICATARRHAL. A remedy for catarrh.

ANTICAUSOTIC. A remedy for high fever.

ANTICONTAGIOUS. A disinfectant.

ANTICONVULSIVE. A remedy for spasms.

ANTICOSMETIC. Destructive to beauty.

ANTICNEMION. The shin.

ANTICUS. Anterior.

ANTIDOTAL. That which counteracts poison.

ANTIDYNOUS. Anodyne.

ANTIDYSENTERIC. A remedy for dysentery.

ANTIEMETIC. A remedy for vomiting.

ANTIEPILEPTIC. A remedy for epilepsy.

ANTIFEBRIL. A remedy for fever.

ANTIFLATULENT. A remedy for wind in the stomach.

ANTIGALACTIC. A medicine repressing the secretion of milk.

ANTIGUGGLER. A siphon introduced into the neck of a bottle for drawing off the liquor without the sediment.

ANTIHECTIC. A remedy for hectic diseases.

ANTHELMINTICUS. A remedy for worms.

ANTHELIX. A projection upon the outer ear.

ANTHEMORRHAGIC. A remedy for hemorrhage.

ANTHEMORRHOIDAL. A remedy for piles.

ANTHYDROPHOBIC. A remedy for hydrophobia.

ANTHYDROPIC. A remedy for dropsy.

ANTHYPNOTIC. A remedy for sleepiness.

ANTHYPOCHONDRIAC. A remedy for depression of spirits.

ANTHYSTERIC. A remedy for hysteria.

ANTICTERIC. A remedy for jaundice.

ANTILABIUM. Against the lips.

ANTILETHARGIC. Opposed to sleep.

ANTILITHIC. A preventive of stone in the bladder.

ANTILOIMIC. A remedy for the plague.

ANTIMEPHITIC. A remedy against bad gases.

ANTIMONIAC. A preparation of antimony.

ANTIMONIAL POWDER. (James's Powder.) A medicinal powder composed of oxide of antimony and precipitated phosphate of lime.

ANTIMONIATE OF POTASSA. A salt formed by the union of antimoniac acid and potassa. A white invisible powder.

ANTIMONIATED HYDROGEN. A colorless, odorless, combustible gas formed by treating an alloy of zinc and antimony with hydrochloric acid. Formula, H_3Sb .

ANTIMONIC ACID. A yellow powder produced by digesting the metal in nitric acid and driving off excess of acid at a moderately high temperature.

ANTIMONII ET POTASSAE TARTRAS. (Tartar Emetic.) A salt formed by boiling together oxide of antimony and cream of tartar. Much used as a medicine but violently poisonous in large quantity.

ANTIMONIUM. (See Antimony.)

ANTIMONY. *Symbol, Sb.* A bright bluish-white metal, exceedingly brittle and melting at 450°C. If heated strongly it burns with a white flame. It forms various useful alloys, of which type-metal (lead and antimony) is most important.

ANTIMONY WINE. A preparation of tartar emetic and sherry wine.

ANTINEPHRITIC. A remedy for kidney-diseases.

ANTINEUROPATHIC. Nervine.

ANTINEUROTIC. Nervine.

ANTIODONTALGIA. A remedy for toothache.

ANTIPARALYTIC. A remedy for palsy.

ANTIPATHIA. Aversion.

ANTIPATHIC. Opposed; adverse.

ANTIPERIODIC. A remedy for periodic diseases, such as ague.

ANTIPERISTALTIC. Inverted action of intestines.

ANTIPERISTASIS. The action by which a body attacked gains force by opposition.

ANTIPERNIUS. A remedy for chilblains.

ANTIPERTUSSIS. A remedy for whooping-cough.

ANTIPHLOGISTIC. A remedy for fever.

ANTIPHTHEIRIACA. A remedy for lice.

ANTIPLEURITIC. A remedy for pleurisy.

ANTIPODRAGIC. A remedy for calculus.

ANTIPSORIC. A remedy for itch.

ANTIPUTRESCENT. A remedy for putrefaction; an antiseptic.

ANTIPYIC. A remedy for the formation of pus.

ANTIPYRETIC. A remedy for fever.

ANTIPYROTIC. A remedy for burns.

ANTIQUUS. (L.) Chronic; of long standing.

ANTIRHACHITIC. A remedy for rickets.

ANTIRHEUMATIC. A remedy for rheumatism.

ANTISCORBUTIC. A remedy for scurvy.

ANTISEPTIC. A remedy for putrefaction.

ANTISIALAGOGUE. A remedy for salivation.

ANTISPASMODIC. A remedy for convulsions.

ANTISPLENITIC. A remedy for diseases of the spleen.

ANTISTASIS. Antagonism; opposition.

ANTISTRUMATIC. A remedy for scrofula.

ANTISYPHILITIC. A remedy for syphilis.

ANTITASIS. Counter extension.

ANTITHERMA. A cooler.

ANTITYPICUS. Antiperiodic.

ANTIVENEREAL. A remedy for venereal diseases.

ANTIVERMICULAR. Opposed to the downward movement of the bowels.

ANTIZYMIC. Opposed to fermentation.

ANTIZYMOTIC. A destroyer of microscopic beings which are hostile to human health.

ANTLIA. A syringe.

ANTODYNUS. An anodyne.

ANTONII SANCTI IGNIS. (L.) (Saint Anthony's Fire.) Erysipelas.

ANTOZONE. The state of oxygen as it exists in the peroxide of hydrogen.

ANTRUM. A cavern; hollow in bones.

ANTRUM AURIS TYMPANUM. (L.) Labyrinth of the ear.

ANTRUM OF HIGHMORE. Cavity in the upper jaw.

ANUS. The orifice of the rectum.

AOCHLESIA. Calmness.

AORTA. The great artery, given off from the left side of the heart, divided into the ascending aorta, the arch of the aorta and the descending aorta. See plate.

AORTIC. Pertaining to the aorta.

AORTITIS. Inflammation of the aorta.

AORTRA. A lobe of the lungs.

APANTHROPIA. (G.) Man-hatred.

APATITE. Native phosphate of lime.

APECHMA. (G.) A counter-blow.

APELLA. A prepuce which does not cover the *glans penis*.

APEPSIA. (G.) Dyspepsia; indigestion.

APERIENT. A laxative medicine.

APERITIVE SAFFRON OF MARS. (See Carbonate of Iron, Precipitate.)

APETALOUS. Having no petals.

APHÆRESIS. (G.) Cutting off.

APHLEXIA. (G.) Mental abstraction.

APHODUS. (G.) Excrement.

APHLOGISTIC. Flameless.

APHONIA. (G.) Loss of voice.

APHRODISIAC. A medicine supposed to excite venereal desire.

APHTHÆ. White ulcers in the throat.

APHTHOUS. Affected with aphthæ.

APIIN. A peculiar gelatinous substance, resembling pectic acid in appearance, obtained from the parsley herb.

APIOL. A substance obtained from parsley seed.

APILEPSY. Apoplexy.

APIRINA. An alkaloid obtained from the seeds of *Cocos lapidea*. It is white, inodorous, of a sharp taste and fusible.

APIS MELLIFICA. (L.) The honey-bee.

APIUM PETROSELINUM. (L.) Common parsley.

APLASTIC. Not capable of forming an organ.

APLOTOMY. A simple incision.

APNŒA. (G.) Suffocation.

APO. A prefix, meaning *from*.

APOCOPI. (G.) Eunuchs.

APOCRUSTIC. A constringent medicine.

APOCYNIN. An active principle from the root of Indian hemp.

APODEMIALGIA. (G.) Homesickness, nostalgia.

APOGONUM. A living fetus.

APOMORPHIA. A salt obtained by digesting morphia in concentrated hydrochloric acid at a high temperature for several hours. It differs from morphia in containing an equivalent less of hydrogen and oxygen.

APOMYXIA. Mucus of the nose.

APONEUROSIS. A fibrous membrane similar in structure to the tendons.

APONEUROTIC FASCIA. A dense, fibrous membrane forming sheaths for the muscles, and affording them broad surfaces for attachment.

APONIA. Freedom from pain.

APOPHLEGMATIC. A medicine inducing the discharge of phlegm.

APOPHTHORA. (G.) An abortion.

APOPHYSIS. The projecting end of a bone.

APOPLEXIA. Apoplexy. A disease caused by pressure on the brain.

APOPNIXIS. (G.) Suffocation.

APOSIA. Lack of thirst.

APOSITIA. (G.) Distaste for food.

APOSITIC. A destroyer of appetite.

APOSTAXIS. Distillation.

APOSTEME. An abscess.

APOTOKUS. (G.) An abortive fetus.

APOTOMA. (G.) Amputation.

APOZEM. A decoction.

APPARATUS. A set of instruments for performing an operation or experiment.

APPENDICULA VERMIFORMIS. (L.) A wormlike excrescence upon the intestine.

APPENDICULA CEREBRI. (L.) The pituitary gland.

APPERT'S PROCESS. A process of sealing bottles, which consists in heating and sealing when quite full.

APPETENCE. Desire.

APPETITE. Desire of gratification, either of the body or the mind.

APPROXIMATE. Nearest to; next; near to. *Approximate principles* are those which are nearly, but not absolutely equal.

APYRETIC.) Intermission of fe-
APYREXIA. (ver.

APYROUS. Incombustible, or that which sustains a strong heat without alteration of form or properties. Apyrous bodies differ from those simply refractory; the latter bodies cannot be fused by heat, but may be altered.

AQUA. (Latin for *water*.) Water.

Bulliens; boiling water.

Calcis; lime water.

Distillata; distilled water.

Ex Nive; snow water.

Fervens; hot water.

Fontana; spring water.

Fortis; nitric acid.

Glacies; ice water.

Marina; sea water.

Picea; tar water.

Pluvialis; rain water.

Regia; nitro-muriatic acid.

Sodacia; soda water.

Tepida; lukewarm water.

AQUATIC. Living in the water.

AQUATINTA. A process of etching.

AQUEDUCTUS. (L.) A canal in the human body.

AQUEOUS. Watery.

AQUEOUS HUMOR. Watery fluid occupying the anterior and posterior chambers of the eye.

AQUOSE. Aqueous.

AQUIFORM. Of watery form.

AQUILEGIA. The plant Columbine. It is said to be diuretic, diaphoretic, and antiscorbutic, but possesses dangerous properties.

ARABIC ACID. (*Arabin*.) Pure

gum or arabin consists of a substance soluble in water, having acid properties combined with about 3 per cent of lime, forming a soluble salt. It may be obtained in a soluble state by decomposing gum arabic by means of oxalic acid, which separates the lime without modifying the condition of the acid.

ARABIN. (See Arabic Acid.)

ARACHIC ACID. An acid obtained from peanut oil.

ARACHNITIS. Inflammation of the arachnoid.

ARACHNOID. (Greek, *arachne*, "a spider.") The cobweb-like serous membrane between the outer and inner membranes of the brain. (See *Dura Mater* and *Pia Mater*.)

ARACK. A spirituous liquor made in the East Indies from the fermented juice of the cocoanut and rice.

ARANEOUS. Resembling a cobweb.

ARAUCARIA DOMBEYI. (L.) A species of turpentine obtained in Chili.

ARBOR DIANÆ. (L.) (Tree of Diana.) An arborescent precipitation of silver, made by adding mercury to a solution of nitrate of silver.

ARBOR SATURNI. (L.) An arborescent precipitation of lead made by suspending a piece of zinc in a solution of acetate of lead.

ARBOR VITÆ. (L.) An indigenous evergreen tree.

ARBOR VITÆ. (Tree of Life.) The name given to a leaf-like appearance of the cerebellum when cut vertically.

ARBORESCENCE. A tree-shape.

ARBORESCENT. Resembling a tree.

ARBUTIN. A crystalline glucoside obtained from bearberry.

ARCANUM. (L.) A secret medicinal remedy.

ARCEUTHOS. Juniper.

ARCH OF THE AORTA. The turn made in the thorax by the aorta.

ARCH OF THE COLON. Transverse portion of that intestine.

ARCHES OF THE PALATE. Anterior

and posterior curtains on each side of the throat.

ARCHIATER. (G.) A chief physician.

ARCHIL. (See Litmus.)

ARCHIMAGIA. Chemistry.

ARCHIMEDES PRINCIPLE. The law that a body immersed in water displaces a quantity of liquid equal to itself.

ARCTURA UNGUIS. (L.) Ingrowing nails.

ARCTUVINE. A substance obtained by boiling arbutin with sulphuric acid.

ARDAS. Excrement.

ARDENT. Heating; burning.

ARDOR. Heat.

ARDOR URINÆ. (L.) Scalding in urination.

ARDOR VENTRICULI. (L.) Heart-burn.

AREFACTION. Making dry.

ARENA. (L.) Gravel; sand.

ARENACEOUS. Sandy.

ARENATION. A sand bath.

ARENITIS. Dryness.

AREOLA. A colored circle. An opening between tissues.

AREOLAR TISSUE. Loose connective tissue continuous over the whole body.

AREOMETER. An instrument for determining the specific gravity of liquids.

AREOTIC. A medicine which attenuates the humors, dissolves viscosity, opens the pores, and increases perspiration.

ARGAL. Unrefined or crude tartar; a substance adhering to the sides of wine-casks.

ARGAND-LAMP. A lamp invented by Argand in 1780, in which, by means of a hollow wick and a glass chimney, a strong and clear light is produced by placing the flame between two currents of air.

ARGEL. (*Arguel.*) The leaves of *Cynanchum oleæfolium*, or *C. argel*, often mixed with senna. It grows in Upper Egypt and Syria.

ARGENTAL. Silvery.

ARGENTI CHLORIDUM. (Chloride of Silver.) A precipitate obtained by treating nitrate of silver with common salt.

ARGININE. Pertaining to silver.

ARGENTUM. (L.) Silver.

ARGIL. Pure clay.

ARGILLACEOUS. Clay-like.

ARGOL. A salt existing in grape-juice, from which is prepared cream of tartar, which see.

ARGUEL. See Argel.

ARIBINA. An alkaloid contained in *Araribe rubra*.

ARICINA. An alkaline substance obtained from Peruvian bark.

ARID. Dry; parched.

ARMENIAN BOLE. See Bole, Armenian.

ARNICA. A plant common on the mountains of Europe, with a fibrous, aromatic root. Its flowers are used to form a tincture which is used externally in bruises, etc.

ARNICINA. An alkali derived from arnica flowers.

ARNOTTA. (See Annotto.)

AROMA. A fragrant odor.

AROMATIC. Fragrant; spicy.

AROMATIZE. To fill with fragrance.

AROPH. (See Saffron.)

ARRACK. (See Arack.)

ARRHOEA. The suppression of a flux.

ARROW ROOT. A principle of the root-stalk of the *Maranta arundinacea*. It is very nutritious and easily digested.

ARS. (L.) An art.

ARSALTOS. Asphalt.

ARSATUM. Nymphomania.

ARSENAL. A collection of instruments.

ARSENIATE. A salt formed by arsenic acid combined with some base.

ARSENIC. A metal generally occurring in combination with iron, nickel, cobalt or sulphur. It is a

greyish lustrous metal, soon tarnishing in the air. Specific gravity, 5.7. Symbol, As.

ARSENICAL PASTE. A preparation used upon ulcers, composed of sulphuret of mercury and arsenious acid.

ARSENIOUS ACID. (White arsenic.) Formed by burning metallic arsenic, or roasting arsenical pyrites. It is feebly soluble in water, tasteless and devoid of smell, but very poisonous.

ARSENITE. A salt formed by arsenious acid combined with some base.

ARTERIAL. Pertaining to the arteries.

ARTERIAL BLOOD. The red blood of the body.

ARTERIAL DUCT. The duct leading from the pulmonary artery to the aorta in the fetus.

ARTERIAL LIGAMENT. The arterial duct obliterated after birth.

ARTERIAL STIMULANTS. Agents which exhibit their action chiefly on the heart and arteries.

ARTERIOTOMY. Cutting an artery for blood-letting.

ARTERITIS. Inflammation of the arteries.

ARTERY. (Greek *aer*, "air" *tereo* "to hold".) The vessels which convey the red, or arterial blood from the heart. Named arteries from the fact that they are usually found empty after death and hence formerly supposed to contain only air.

ARTHRALGIA. (G.) Neuralgic pains in the joints.

ARTHRITIS. Inflammation of the joints.

ARTHRODIA. A movable joint.

ARTHROSIA. The gout.

ARTHRONALGIA. (G.) Pain in a joint.

ARTHROSIS. Joining.

ARTICULAR. Belonging to the joints.

ARTICULATION. The joining and manner of connection between two or more bony parts, whether they be movable one upon another or not.

ARTIFICIAL BONE BLACK. Wood charcoal treated with phosphate of lime and hydrochloric acid.

ARTIFICIAL CAMPHOR. A compound resulting from the absorption of hydrochloric acid by oil of turpentine.

ARTIFICIAL FRUIT ESSENCE.—Compound ethers with fruit flavor.

ARTIFICIAL GUM. (See Dextrin.).

ARTIFICIAL OIL OF BITTER ALMONDS. Nitrobenzol, possessing the same odor as bitter almonds.

ARTIFICIAL SODA. Common salt converted into sulphate of soda by sulphuric acid, and this reduced to sodium carbonate by carbonate of lime and charcoal.

ARYTAENO-EPIGLOTTICI. (L.) Small muscles of the larynx.

ARYTENOID. (Greek, *arutaina*, "a ewer.") A name given to two triangular cartilages of the larynx from their supposed resemblance to a water-ewer.

ASAFETIDA. A resinous fetid substance obtained by incisions in the root of the *Ferula asafetida*. Easily soluble in vinegar and egg-yolk.

ASBESTOS. (Incremable flax; Salamander's wool.) An incombustible silicate of magnesia, in white filiform masses, which was used by the Romans to prevent admixture of ashes in cremation.

ASBOLIN. A bitter yellow oil obtained from soot.

ASCARIDES. Small worms in the lower intestine.

ASCENDENS. (L.) A portion of the aorta.

ASCITES. Effusion within the abdomen.

ASCLEPIN. An emetic principle contained within the root of the white swallow-wort.

ASCLEPIONE. The principal solid ingredient of the juice of milk-weed.

ASEPSIS. The state of being aseptic.

ASEPTIC. Non-putrifying; not poisonous from dead matter.

ASIATIC PILLS. Pills composed of arsenious acid and black pepper.

ASPALATHUS A fragrant wood found in the Canary islands, yielding an essential oil with the odor of roses.

ASPARAGIN. A crystallized principle obtained from the asparagus.

ASPARAMIDE. (See Asparagin.)

ASPARMIC ACID. (Aspartic Acid.)

A concrete crystalline acid obtained by the action of strong acids on asparagin, and composed of carbon, hydrogen, nitrogen and oxygen.

ASPARTATE. A compound of aspartic acid with a base.

ASPARTIC ACID. (See Asparmic Acid.)

ASPERA ARTERIA. (L.) The wind-pipe.

ASPERITY. A roughness of the bones serving for attachment.

ASPHALTUM. (*Bitumen Judæicum*, Jew's Pitch.) A smooth, hard, brittle black or brown substance; melts easily when heated, and, when pure, burns without leaving any ashes. It has little taste and scarcely any smell unless heated, when it emits a strong smell of pitch. It is found in a liquid or soft state on the surface of the Dead Sea. It is found also in the earth in many parts of Asia, Europe and America. Formerly it was used for embalming dead bodies.

ASPHURELATA. Certain fusible semi-metallic fossils.

ASPHYXIA. Literally, pulselessness. A suspended animation. (See Diseases.)

ASPIC. A French Lavender, from which is extracted a useful oil.

ASPIDIN. The impure active principle of the male fern.

ASPIRATION The drawing in of air.

ASPIRATOR. An instrument used for drawing out the fluid contents of tumors, serous effusions, collections of pus, etc. It somewhat resembles a sub-cutaneous injection syringe.

ASSACOU. A Brazillian tree yielding an intoxicating juice.

ASSAFÆTIDA. (See Asafetida.)

ASSAMAR. A bitter substance, contained in burnt sugar.

ASSAY. The determination of the quantity of a metal in any ore or alloy.

ASSIMILATION. Conversion of food into organic tissues.

ASTHENIA. (G.) Lack of strength; debility; feebleness.

ASTHENOPIA. (G.) Weakness of the eyes.

ASTHENIC. Strengthless.

ASTHMA. A disease in which there is difficulty in respiration.

ASTHOMUS. Without a mouth.

ASTRAGALUS. The ankle-bone.

ASTRAL. Star-like.

ASTRAL LAMP. An argand lamp, having the oil in a flattened ring surmounted by a ground-glass shade.

ASTRINGENT. A medicine which causes contraction of the soft muscles.

ATAXIC. Irregular: nervous.

ATHAMANTIN. A peculiar principle, obtained from mountain parsley.

ATHANOR. A furnace with a side-receptacle for fuel, which maintains a continuous supply.

ATHEROMA. (G.) A pulpy, encysted tumor.

ATHEROMATOUS. Like an atheroma.

ATHEROSPERMIN. An alkaloid, obtained from the Australian sassafras.

ATHLETIC. Vigorous and muscular.

ATLAS. The first vertebra of the neck.

ATMOSPHERIC PRESSURE. The pressure exercised by the air, equaling about fifteen pounds to the square inch.

ATLOIDO-AXOID. Relating to the atlas and the axis.

ATLOIDO-OCCIPITAL. Relating to the atlas or occiput.

ATOM. A small, indivisible portion of matter.

ATOMIC THEORY. The theory that chemical combination consists in the approximation of individual atoms to each other according to their atomic weights.

ATOMIC WEIGHT. The weight of the different atomic elements in reference to the weight of an atom of hydrogen.

ATOMIZE. To reduce to atoms.

ATOMIZER. An instrument for reducing liquids to a fine spray.

ATONY. Debility.

ATRA-BILIOUS. Melancholy.

ATRESIA. Imperforation.

ATROPA BELLADONNA. (Deadly nightshade.) A common European plant, possessing active poisonous properties. Its fruits are especially dangerous from their resemblance to a species of cherry.

ATROPHY. Lack of nourishment; wasting.

ATROPIA. An alkaloid of belladonna.

ATROPIC ACID. An uncrystallizable acid formed from atropine by the action of alkalis.

ATTALEH. The tree yielding Barbary gum.

ATTAR OF ROSES. (Otto of Roses.) A volatile oil obtained from rose-leaves, used for perfumery and flavoring.

ATTENUANT. A diluent.

ATTENUATION. Thinness; division.

ATTITUDE. Posture; position.

ATTOLENS. (L.) A lifter; name of certain muscles.

ATTRAHENS. (L.) Muscles of the ear.

ATTRACTION. The force which causes particles of matter to approach each other.

ATTRITUS. Rubbing together; chafing.

ATYPTIC. Irregular.

ATYPOS. (G.) Without type; irregular.

AUANSIS. Drying.

AUDITORY. (Latin, *audio* "to hear.") Belonging to the parts of hearing.

AUME. A Dutch measure, equivalent to forty gallons.

AURA EPILEPTICA. A warning preceding an attack of epilepsy.

AURANTII OLEUM. The oil of orange flowers, obtained by distillation.

AURATE. A combination of auric acid with some base.

AURIC ACID. An acid obtained by decomposing the sesquichloride of gold by potassa, and precipitating the acid by hydrochloric acid. Formula, Au_2O_3 .

AURICLES. From their supposed resemblance to ears, a name given to the two upper cavities of the heart. (See plate 6.)

AURICULA. (Latin, *auris* "an ear.") The prominent part of the ear.

AURICULAR. Pertaining to the ear.

AURICULARIS ABDUCTOR. (L.) A muscle of the little finger.

AURICULO-VENTRICULAR VALVES. Certain valves of the heart.

AURICULUM RETRAHENTES. (L.) Muscles of the ear.

AURIGO. Jaundice.

AURI PIGMENTUM. The sesquisulphuret of arsenic.

AURIS. (L.) The ear.

AURIST. An ear surgeon.

AURIUM TINNITUS. (L.) A ringing in the ears.

AURIUM SORDES. (L.) Ear wax.

AURUGO. (See Aurigo.)

AURUM. (L.) Gold.

AUSCULTATION. The art of diagnosis by listening to the sound of the lungs and other organs.

AUSTRALIAN GUM. A somewhat insoluble Australian species of gum arabic.

AUTOCRACY. The power over one's organism. The vital principle.

AUTOMATIC. Actions which are not dependent upon the mind.

AUTOPLASTIC. The art of transplanting skin.

AUTOPSIA CADAVERIS. (L.) (See Autopsy.)

AUTOPSY. An examination of a dead body for the determination of the cause of death.

AVA. An intoxicating drink of the Sandwich Islands, prepared from a native root.

AVENA SATIVA. The oat.

AVENS. (*Geum urbanum.*) A European plant with an aromatic root, sometimes used medicinally.

AVERUNCATE. To tear out by the roots.

AVOIRDUPOIS. A weight whose pound contains sixteen ounces. Its proportion to a pound Troy is as 17 to 14.

AVORTIN. Abortion.

AXILLA. The angle formed by a branch and its stem.

AXILLARY. Pertaining to the arm-pit.

AXIS. A right line which passes through the center of a body. (See Plate 1.)

AXIS CYLINDER OF NERVE. The central portion of the fibrils of tubular nerve fiber, surrounded by medullary substance.

AXIS VESSELS. (See Coelic Axis.)

AXUNGE. Prepared lard.

AZOBENZOLE. A compound obtained from anilin.

AZOIC. Destitute of life.

AZOLITININ. One of the coloring matters of litmus.

AZOTE. That which cannot sustain life. An old name for nitrogen.

AZOTIC ACID. (See Nitric Acid.)

AZOTITE. (Nitrite.) A salt formed by the combination of nitrous acid with a base.

AZOTIZED. Nitrogenized.

AZURE. The blue color of the sky.

AZYGOS. (G.) Without a similar one; a name given to certain veins.

AZYMOS. Unleavened; unfermented.

B.

BA. Symbol for barium.

BACCHICA. (L.) Ivy.

BACCIFEROUS. Berry-bearing.

BACCILLUM. A little berry.

BACILLUS. (A staff.) A genus of vegetable infusoria.

BACTERIA. (See Bacterium.)

BACTERIUM. (Plural, Bacteria.) A genus of infusoria, among the lowest forms of life, which swarm in all putrefying solutions of organic matter. (See Sec. 5.)

BACTERIUM TERMO. One of the most common species of Bacterium.

BAGNIO. A bath-house.

BAHEL. A plant of Malabar.

BALENIC ACID. An acid obtained from whale-oil.

BALANITIS. Inflammation occurring in the mucous membrane lining the prepuce.

BALANUS. An acorn; glans penis.

BALBUS. (L.) Tongue-tied.

BALLOTTEMENT. Falling back of the foetus; a diagnosis of pregnancy.

BALM. The medicinal herb *Melissa officinalis*.

BALM OF GILEAD. (See *Amyris Gileadensis*.)

BALM OF GILEAD TREE. (See *Abies balsamea*.)

BALM OF MUMMIES. A preparation from human mummies, used in ancient times as a medicine and antidote to poisons of all kinds.

BALMONY. Snake's-head; a bitter herb.

BALNEUM. (L.) A bath.

BALSAM, CANADA. (See *Abies balsamea*.)

BALSAM, CARPATHIAN. A product of the Siberian stone-pine of the Alps and Carpathian mountains.

BALSAM OF COPAIVA. (See *Copaiva*.)

BALSAM OF FIR. (See *Abies balsamea* and Antiseptics.)

BALSAM OF GILEAD. (See *Amyris Gileadensis*.)

BALSAM, HUNGARIAN. A balsam obtained from the *Pinus pumilio*, resembling oil of juniper.

BALSAM OF PERU. (*Balsamum Peruvianum*.) The prepared juice of *Myrospermum Peruiferum*, or *Myroxylon Peruiferum*, a tree growing in Central America. It is a viscid, syrup-like substance, of a dark reddish-brown color, a fragrant odor and bitterish taste.

BALSAM RIGA. (*Balsamum Carpaticum*, *Balsamum Libani*.) A product of *Pinus cembra*, a large tree growing in Europe and Asia. It has an odor like that of juniper and possesses like properties.

BALSAM OF SULPHUR. (Sulphurated oil.) A name formerly given to a substance resulting from the reaction of sulphur upon olive oil at a high temperature.

BALSAM OF TOLU. (*Balsamum Tolutanum*.) The juice of *Myrospermum toluiferum*, or *Myroxylon toluiferum*. It is a stimulant tonic, with a peculiar tendency to the pulmonary organs.

BALSAM WEEED. (*Impatiens Fulva* and *Impatiens Pallida*, Touch-me-not.) Succulent plants, known by their tender, juicy, almost transparent stems. It is an emetic and cathartic.

BALSAM, WHITE. (See Balsam of Peru.)

BALSAMIC. Having the qualities of balsam.

BALSAMIFEROUS. Producing balsam.

BALSAMODENDRON MYRRHA. A small tree growing in Arabia Felix. The juice, which exudes spontaneously and concretes upon the bark, constitutes the gum myrrh of commerce.

BALSAMUM MORTUORUM. (L.) Strong tincture of myrrh and aloes.

BANDAGE. A strip of linen or flannel used for binding or compressing a part of the body.

BANDOLINE. Prepared from gum

tragacanth, six ounces, rose water, one gallon, otto of rose, a half ounce. The gum to be steeped in the water and agitated as it swells.

The soft mass to be carefully pressed through coarse linen cloth and the otto of rose thoroughly mixed.

BANE. Deadly poison.

BANG. The larger leaves and seed-cases of Indian hemp.

BARBADOES ALOES. (See *Aloe Barbadosensis*.)

BARBADOES LEG. *Elephantiasis*.

BARBADOES NUTS. The seeds of the *Jatropha curcas* yielding an oil similar to croton oil.

BARBADOES PETROLEUM. (See Barbadoes Tar.)

BARBADOES TAR. A thick mineral fluid of nauseous taste and strong smell, viscid, and of dark color, used in coughs and lung diseases.

BARBARY GUM. (See Attaleh.)

BARBATE. Bearded.

BARIUM. Metallic basis of heavy spar.

BARII CHLORIDUM. Chloride of barium. A white soluble salt of disagreeable taste.

BARII IODIUM. Iodide of barium. A chemical compound formed by double decomposition from carbonate of baryta and iodide of iron; used in scrofulous troubles.

BARILLA. Impure soda-ash from which carbonate of soda is obtained, used in making soap and glass and bleaching. Obtained from burning certain plants.

BARK. The exterior covering of a tree corresponding to the skin of an animal. This is composed of the cuticle or epidermis, the outer bark or cortex, and the inner bark or liber. The rough, broken matter on bark is sometimes called ross.

BARK, CALISAYA. (Yellow Cinchona Bark.) A variety of Peruvian bark containing not less than two per cent of alkaloids yielding crystallizable salts.

BARK, PALE. (*Cinchona Pallida*.) The bark of *Cinchona condaminea* and of *Cinchona micrantha*, a species of Peruvian bark.

BARK, RED. (*Cinchona Rubra*.) The bark of an undetermined species of cinchona, containing not less than two per cent of alkaloids yielding crystallizable salts.

BAROLITE. Carbonate of baryta.

BAROMETER. An instrument to measure the weight of the air.

BARRAS. The resin which exudes from wounds made in the barks of fir trees.

BARROWS. Hills or mounds of earth, designed as repositories for the dead.

BARYTA. A heavy alkaline earth; an oxide of barium.

BARYTA CARBONATE. { (See Baryta.)

BARYTA SULPHATE. { (See Baryta.)

BARYTA MURIATE. (See *Barii Chloridum*.)

BARYTA WATER. A reagent formed by the solution of baryta in water.

BARYTINA. A vegetable alkaloid said to be contained in white hellebore, named from its being precipitated like baryta from its solution in acetic acid by sulphuric acid.

BASAL. Pertaining to the base.

BASE. Any alkaline or earthly substance, combining with an acid, forms a compound or salt, of which it is the *base*.

BASEMENT MEMBRANE. A delicate structureless membrane, found beneath the epidermis or epithelium.

BASIC. This term is often applied to a salt in which the base is in excess or constitutes a large proportion of the neutral salt.

BASIL. A medicinal herb.

BASILAR PROCESS. A process on the occipital bone.

BASILARY. Pertaining to the base.

BASILIC VEIN. A vein at the bend of the arm.

BASILICON. An ointment made of wax, resin, etc.

BASILICUS. Syphilis.

BASIOGLOSSI. Two muscles depressing the tongue.

BASIOPHARYNGEL. Muscles of the *os hyoides*.

BASTARD. Illegitimate; delusive symptoms applied to certain diseases resembling others.

BATH. A vessel placed over a fire and filled with any substance, into which another vessel is placed containing matters for digestion, evaporation, or distillation.

BATHMIS. Base; support.

BATTARISMUS. Stammering.

BATTEMENT. (F.) Pulse.

BATTERY. A number of coated electrical jars placed in such a manner that they may be charged at the same time, and discharged in the same manner.

A *galvanic battery* is a pile or series of plates of copper and zinc, or of any substance susceptible of galvanic action.

BAUME'S HYDROMETER. An instrument used by apothecaries for determining the specific gravity of liquids.

BAYBERRY TALLOW. A white, cerous substance obtained from the bayberry or wax myrtle.

BAY LEAVES. The leaves of the *Laurus nobilis*. They are fragrant and aromatic in taste, and yield a volatile oil upon distillation.

BAY RUM. A spirit obtained by distilling the leaves of the *Myrcia acris* in rum.

BAY SALT. A salt which forms upon the surface of water containing saline matter in solution under the action of natural heat.

BDELLIUM. A dark-colored gum produced in the East Indies and Arabia, used as a perfume and medicine.

BEAN OF CALABAR. A poisonous bean produced by the *Physostigma venenosum*. It has been used in tetanus and paralysis.

BEAN OF ST. IGNATIUS. The seed of a tree native of the Philip-

pine Islands, and acting like nuxvomica.

BEBEERÆ SULPHAS. (Sulphate of Bebeeria.) A tonic used in uterine diseases.

BEBEERIC ACID. A white crystalline acid obtained from the seeds of the *Nectandra*.

BEBEERIN. } An alkaloid of the
BEBEERIA. } bark of the Nectandra tree.

BEECH DROPS. } Oil obtained from
BEECH OIL. { beech-nuts and used in parts of France in place of butter.

BEGONIA. A genus of plants.

BEHENIC ACID. An acid from Behen oil, possessing the formula $C_{21}H_{42}O_2$.

BEHENOLIC ACID. An acid formed by the action of an alcoholic solution of potassa upon the bromide of erucic acid. It is similar to stearolic acid.

BELLADONNA. (See *Atropa*.)

BELLADONIN. An alkaline principle obtained from belladonna.

BELLOWS SOUND. The blowing of the lungs recognized in auscultation.

BEN. } A nut, the fruit of the

BEN-NUT. } *Morynga pterygosperma*, yielding an oil called oil of ben. The nut attains the size of a filbert, and possesses purgative properties.

BENE. A name of the *Sesamum orientale* or oil plant.

BENIC ACID. An acid obtained by the saponification of the oil of ben.

BENNE LEAF. The leaves of *Sesamum Indicum* and of *S. orientale*. They impart a gummy matter to water, forming a mucilage, used in the South as a drink in complaints to which demulcents are applicable.

BENNE OIL. (*Oleum Sesami*.) The oil of the seeds of *Sesamum Indicum* and *S. orientale*. It somewhat resembles olive oil in its properties.

BENZENE. (*Benzine, Phene, Hydruret of Phenyl*.) A Hydrocarbon of a definite composition, originally prepared by distilling benzoic acid with lime, but afterward discovered to be a constituent of coal-gas tar, which, when distilled, furnishes *coal naphtha*, or the commercial benzene, a complex substance, containing a number of carbohydrogens, among which is benzole. Its composition is C_6H_6 .

BENZINATED LARD. Lard prepared for preservation by adding to one thousand parts of it, when melted, sixty parts of a tincture of benzoin, or poplar buds, or guaiac prepared by percolation from one part of the drug to four of alcohol, agitating the mixture till it cools.

BENZINE. (See Benzene.)

BENZOATE. A salt formed by the union of benzoic acid with any salifiable base.

BENZOATE OF SODA. (*Sodæ Benzoas*.) A salt prepared by saturating a solution of benzoic acid with a solution of carbonate of soda. Used in gout and rheumatism.

BENZOIC ACID. (See Acid, Benzoic.)

BENZOIN. (Gum Benzoin.) A resinous juice, flowing from the *Styrax benzoin*. By heat or partial decomposition it yields benzoic acid. It flows from incisions made in the stems or branches. It is solid or brittle, sometimes in yellowish white tears joined together by a brown substance.

BENZOIN FLOWERS. (Flowers of Benzoin.) A name formerly applied to benzoic acid, from the mode of preparing by sublimation.

BENZOIN ODORIFERUM. (*Laurus Benzoin, Spice Bush, Fever Bush*.) A shrub growing in all parts of this country, having a spicy, agreeable flavor, which is strongest in the bark and berries.

BENZOLE. (See Benzene.)

BENZOLIC ACID. An acid formed

by heating potassa dissolved in alcohol with benzole.

BENZONITRIL. One of the products of naphthalin, which becomes benzoate of soda when boiled with a solution of caustic soda.

BENZOYL. The radical of benzoic acid.

BENZYL. A compound radical contained in the oil of bitter almonds.

BERBERIN. (*Berberina*.) An alkaloid obtained from the root of the common barberry.

BERBINA. An alkaloid obtained from the root of the barberry; not identical with Berberin.

BERGAMOT. A fragrant citron whose rind yields an oil used for perfumers.

BERBERI. A spasmodic disease of India.

BERLIN BLUE. (See Prussian Blue.)

BETA. The beet.

BETULA. Birch.

BETULIN. A peculiar white principle, ranked among the sub-resins, obtained from the bark of the *Betula alba* or European birch by the aid of alcohol.

BEZOAR. A name given to concretions or calculi formed in the stomach or intestines of animals, which were formerly thought to possess great medical virtues.

BEZOAR MINERAL. A preparation of oxide of antimony, produced by distilling the nitrous acid several times to dryness from the sublimated muriate of antimony.

Bi. Bi in composition denotes that the compound contains two parts or equivalents of the first mentioned ingredient to one of the other.

Bi-ACID. Capable of combining with two parts or equivalents.

BIBASIC PHOSPHATE OF SODA. Phosphate of soda deprived of its basic water by heat.

BIBASIC PHOSPHORIC ACID. One

of the isomeric conditions assumed by phosphoric acid in its production by heat.

BIBORATE OF SODA. (See Borax.)

BIBROMIDE OF MERCURY. An irritant poison obtained by digesting the protobromide of mercury in water containing bromide.

BIBULOUS. Spongy; absorbent; that has the quality of imbibing fluids or moisture; as bibulous paper.

BICARBONATE. A carbonate consisting of two equivalents of carbonic acid to one of base; a supercarbonate.

BICARBONATE OF POTASSA. Carbonate of potassa combined with an additional equivalent of carbonic acid by passing a stream of the latter through a solution of the carbonate until it is saturated.

BICARBONATE OF SODA. Carbonate or sal soda united with an additional equivalent of carbonic acid. It consists of two equivalents of carbonic acid, one of soda, and one of water.

BICEPS. Two-headed; applied to muscles.

BICHLORIDE OF CARBON. (Chloro-carbon.) An anæsthetic similar in its effects to chloroform.

BICHLORIDE OF ETHYL. (Bichloride of Methylen, Chloromethyl.) An anæsthetic prepared by exposing to sunshine in a glass globe chlorine and gaseous chloride of methyl.

BICHLORIDE OF ETHYLEN. (Dutch Liquid.) An anæsthetic compound resulting from the mutual action of chlorine and olefiant gas, and having the formula $C_2H_4Cl_2$.

BICHLORIDE OF MERCURY. (Corrosive Sublimate.) A powerful preparation of mercury, long used as a remedy in syphilis, in skin diseases, and in chronic rheumatism. It may be prepared by dissolving red precipitate in muriatic acid, evaporating the solution to dryness, dissolving the dry mass in water, and crystallizing.

BICHLORIDE OF METHYL. (See Bichloride of Ethyl.)

BICHRIMATE. A salt containing two equivalents of chromic acid to one of base.

BICHRIMATE OF POTASSA. (*Potassæ Bichromas*, Red Chromate of Potassa.) A salt prepared from the neutral or yellow chromate of potassa, by acidulating its solution with sulphuric acid, and setting aside for a day or two. It is used as an alterative, emetic, an irritant, a caustic, and as a dye.

BICIPITAL GROOVE. A groove on the humerus.

BICUSPIDS. First molar teeth.

BICYANIDE OF MERCURY. (Prussiate of Mercury, Cyanide of Mercury, *Hydrargyri Cyanidum*.) A preparation composed of one equivalent of mercury, and two of cyanogen. It is a violent poison, but it is sometimes employed medicinally in lieu of corrosive sublimate.

BIDENS. A genus of plants.

BIENNIAL. A botanical term descriptive of plants whose life extends through two years.

BIFURCATE. To divide into two branches.

BILABATE. With two lips.

BILATE OF SODA. A sodium compound largely occurring in bile.

BILATERAL. Two-sided.

BILE. Gall secreted by the liver.

BILIARY. Pertaining to bile.

BILIFULVIN. A salt of lime and soda in connection with a peculiar azotized acid which occurs in the bile of the ox.

BILIFUSCIN. A blackish substance obtained from human gallstones.

BILIN. The principal constituent of ox-gall. An odorless, colorless, acid substance, freely soluble in water.

BILIOUS. Abounding in bile.

BILIPHÆIN. A name for the brown coloring matter of bile.

BILIPRASIN. A black substance,

insoluble in water, found in gallstones.

BILIRUBIN. A red coloring matter found in human bile.

BILIS. (L.) The bile.

BILIVERDIN. A green powder, obtained from green bile.

BILOBED. Having two lobes.

BINARY COMPOUND. In chemistry, applied to compounds of two simple elements. Thus cinnabar, composed of sulphur and mercury, is a binary compound. Where a compound performs the function of a simple element, it may form one of the constituents of a binary compound.

BINATUS. (L.) In pairs.

BINDER. A bandage.

BINIODIDE OF MERCURY. (Red Iodide of Mercury.) A compound produced by precipitation from aqueous solutions of corrosive sublimate and iodide of potassium. It is an irritant poison, used medicinally in syphilis and epilepsy.

BINITROSULPHURET OF IRON. A substance obtained from nitrate of potassa and hydrosulphite of ammonia mixed with protosulphate of iron. It is used in testing the purity of chloroform.

BINOCULAR. Vision with two eyes.

BINOCULUS. A bandage applied to both eyes.

BIOCHYMIA. Vital chemistry.

BINOXALATE OF POTASSA. (Salt of Sorrel.) A salt obtained by neutralizing with potassa oxalic acid in solution, and adding another part of the acid, after which it is evaporated to the crystallization point.

BIOD. Life.

BIOLOGY. The science of life.

BIOLYCHNIUM. Animal heat.

BIONOMY. Physiology.

Bios. (G.) Life.

BIPED. Two-footed.

BIPINNA. Two-feathered.

BIRACEMATE OF POTASSA. (Paratartrate of Potassa.) A salt discov-

ered in wine, said to be an evidence of its superiority. It is in octagonal crystals.

BIRDLIME. A viscid substance existing in various plants, particularly in the bark of *Viscum album* and *Ilex aquifolium*, or European holly, used in catching birds by smearing it on twigs.

BISCITE. A malignant dysentery of Trinidad.

BISERIAL. Arranged in two rows.

BISMUTH. A metal of a yellowish or reddish-white color. It is somewhat harder than lead, and scarcely, if at all, malleable, being so brittle as to break easily under the hammer, and reducible to powder. It melts at 247° C., and may be fused in the flame of a candle. It is crystallized in pyramidal forms.

BISMUTH CARBONATE. A salt formed by the union of carbonic acid with bismuth. It is used in disorders of the stomach.

BISMUTH MAGISTERY. An old name for the subnitrate of bismuth.

BISMUTH OCHRE. A native oxide of bismuth, sometimes containing a small portion of carbonic acid.

BISMUTH PURIFIED. Bismuth usually contains arsenic and other contaminating metals, which are removed by oxidation.

BISMUTH SUBCARBONATE. (See Bismuth Carbonate.) It is called *subcarbonate* because it contains a less number of equivalents of carbonic acid than of bismuth.

BISMUTH SUBNITRATE. (White Bismuth.) A salt formed by dissolving purified bismuth in nitric acid somewhat diluted, concentrating the solution, and precipitating by adding it to a large quantity of water. It is considered an antispasmodic and absorbent, a sedative and astringent.

BISMUTH TEROXIDE. A yellow oxide of bismuth, formed by burning the metal in the open air, which consists of one equivalent of bismuth and three of oxygen.

BISMUTH VALERIANATE. (*Bismuthi Valerianas.*) A salt formed by the double decomposition between solutions of ternitrate of bismuth and valerianate of soda. It is used in neuralgia and painful affections of the stomach.

BISMUTHIC ACID. A compound of bismuth and oxygen, possessing acid properties, and consisting of one equivalent of the former to five of the latter.

BISMUTHUM. (See Bismuth.)

BISMUTHUM ALBUM. (See Bismuth Subnitrate.)

BISTOURY. A small knife used by surgeons.

BISULPHATE. A sulphate consisting of two equivalents of sulphuric acid to one of base; a super-sulphate.

BISULPHATE OF ALCOHOL. (Bisulphate of Ether.) A double sulphate of ether and water.

BISULPHATE OF POTASSA. (*Potassæ Bisulphas.*) A salt prepared by placing together in a small porcelain capsule, to which heat is applied until acid vapors cease to rise, three ounces of sulphate of potassa and one of pure sulphuric acid.

BISULPHATE OF QUINIA. (Super-sulphate of Quinia.) A salt of quinia consisting of two equivalents of sulphuric acid to one of quinia.

BISULPHIDE OF CARBON. (Carburet of Sulphur.) A compound formed by passing the vapor of sulphur over charcoal heated to redness in a porcelain tube. It is used internally and externally in rheumatism, paralysis, cutaneous affections, and as a solvent in the arts and manufactures.

BISULPHATE OF LIME. A salt prepared by passing sulphurous acid in excess through a solution of the sulphite of lime.

BISULPHURET. A sulphuret with two atoms of sulphur as the electro-negative ingredient; a deuto-sulphuret.

BISULPHURET OF ARSENIC. (See Realgar.)

BISULPHURET OF IODINE. (Iodide of Sulphur, Sulphuric Iodidum.) A preparation resulting from the perfect combination of iodine and sulphur in the proportion of four parts of the former to one of the latter. It is a useful remedy in skin diseases.

BISULPHURET OF MERCURY. (Red Sulphuret of Mercury, Cinnabar.) A preparation formed by the union of mercury and sulphur by heat, and sublimated. To render the combination more prompt, the sulphur should first be melted.

BITARTRATE OF POTASSA. Cream of tartar. (See Acid Tartrate.)

BITTER ALMOND. (See Almond.)

BITTER SALT. (See Epsom Salt.)

BITTERN. The brine remaining in salt works after the salt is concreted.

BITTOS. A disease of the anus.

BITUMENS. Liquids or solids which emit when heated, a peculiar odor, burn easily, emitting a thick and very odorous smoke. All bitumens are bitter and stimulating.

BIVENTER. (L.) Two-bellied.

BIXA. A genus of plants.

BIXIC ACID. An acid obtained from the *Bixa Orellana*.

BIXIN. The coloring principle of the *Bixa Orellana*. It forms crystals which become very yellow upon exposure to the air.

BLABE. A wound.

BLACK ANTIMONY. (See *Antimonii Sulphuretum*.)

BLACK ASH. (Soda Ball.) A black mass formed by fusing together dried sulphate of soda, with its own weight of limestone, and half its weight of small coal.

BLACK CYANIDE OF POTASSIUM. An impure cyanide found in the retort after the preparation of the pure article.

BLACK FLUX. A name given to cream of tartar burned with half its weight of nitrate of potassa.

BLACK LEAD. (Plumbago, Carburet of Iron.) A mineral composed of carbon with a small portion of iron. It has been used remedially in skin diseases.

BLACK MERCURIAL LOTION. (See *Lotio Hydrargyri Nigra*.)

BLACK OXIDE OF COPPER. The monoxide of copper obtained by heating to redness the nitrate of copper. Used externally in induration of the glands.

BLACK OXIDE OF MANGANESE. (Peroxide of Manganese, Pyrolusite, Braunstein.) Native impure dioxide of manganese in powder, containing sixty-six per cent of the pure dioxide. It is considered tonic and alterative, and is used in the arts for obtaining chlorine in the manufacture of chloride of lime.

BLACK OXIDE OF MERCURY. A preparation consisting of one equivalent of mercury and one of oxygen, and may be prepared by decomposing a solution of nitrate of protoxide of mercury by solution of potassa.

BLACK PIGMENT. A fine, light, carbonaceous substance, or lamp-black. It is obtained from coal-tar.

BLACK SALTS. A black matter of the consistence of brown sugar, resulting from the evaporation of lye in the manufacture of potash.

BLACK SULPHURET OF MERCURY. An old preparation made by triturating together equal parts of sulphur and mercury until the globules disappear.

BLADDER. The receptacle of urine in man and the lower animals.

BLÆSUS. A distortion.

BLAIN. Vesicular eruption.

BLANCH. To make white by stripping off the peel; whitening, bleaching.

BLANCHIMETER. An instrument for measuring the bleaching power of chloride of lime and potash.

BLAND. Mild, soft, gentle.

- BLASTEMA. A germ.
- BLEACHING POWDER. Chloride of lime.
- BLEB. A small bladder.
- BLECHNUM. A genus of ferns.
- BLENNA. Mucus.
- BLENNA NARIUM. Mucus of the nose.
- BLENNOPTYSIS. Catarrh.
- BLENNORRHEA. A flow of mucus; gleet.
- BLENNORHAGIA. Gleet.
- BLENNOSSES. Affections of mucous tissues.
- BLEPHARON. The eyelid.
- BLEPHARONCUS. A tumor on the eyelid.
- BLEPHAROPLASTICE. Formation of a new eyelid.
- BLESSED THISTLE. (*Centaurea benedicta*.) An herbaceous plant, considered tonic, diaphoretic and emetic.
- BLESSURE. (F.) Wound.
- BLESTRISMUS. Restlessness of the sick.
- BLETA ALBA. Milky urine.
- BLITUM AMERICANUM. Poke-weed.
- BLOOD FIBRINE. A white, tenacious material, obtained from coagulation of the blood.
- BLOCK TIN. Impure tin obtained by melting native tin, roasting it and reducing in the presence of carbon.
- BLOWPIPE. An instrument by which a current of air is driven through a flame which is directed upon some substance which is to be raised to a very high temperature. In the *oxyhydrogen blowpipe* oxygen and hydrogen gases are brought together at the point of combustion, producing so high a temperature that the most difficultly fusible metals, such as platinum, are easily melted, while iron wire held in the flame burns brilliantly.
- BLUE STONE, (See *Cupri Sul-*
BLUE VITRIOL, (*phas.*)
- BOA. An eruption of red, watery pimples.
- BOAE. Syphilis.
- BOCHETUM. A decoction of woods.
- BOCHIA. A glass subliming vessel.
- BOCIUM. Bronchocele.
- BOHEATANNIC ACID. An acid discovered in tea; formula, $C_{11}H_6O_8 + Aq$.
- BOHEIC ACID. An acid obtained from Chinese tea.
- BOIL. A circumscribed inflammation in the cellular tissue.
- BOILING POINT. The degree of temperature at which a fluid is converted into vapor. The boiling point of water is 212° according to the common scale, but 100° by the Centigrade thermometer which is almost universally employed in science.
- BOLA. Myrrh.
- BOLE. A fine smooth clay, often highly-colored by iron.
- BOLE, ARMENIAN. A bright red species, harder than other kinds, and with a rough surface.
- BOLE, FRENCH. Of a pale red color, variegated with specks of white and yellow.
- BOLETIC, ACID. A crystallizable acid discovered in the juice of mushrooms. (*Boletus*.)
- BOLUS. A soft mass of medicine made into a large pill to be swallowed at once.
- BOMBATE. A salt of bombic acid.
- BOMBIC ACID. An acid of the liquid contained in the chrysalis of the silk-worm.
- BOMBUS. Ringing in the ears.
- BONANNIA OFFICINALIS. White mustard.
- BONE. The hardest part of the body, forming the skeleton. Composed of gelatine, phosphate of lime, carbonate of lime, phosphate of magnesia and other components.
- BONE ASH. The residue of bones which have been burned to a white ash.
- BONE BLACK. (Animal Charcoal.) A black substance obtained by calci-

ning bones in close vessels; it is used as a black pigment, and in the refining of sugar.

BONE EARTH. A white substance obtained from calcining bones in open vessels, and chiefly composed of phosphate of lime.

BONE OIL. (See Oil of Dippel.)

BONE PHOSPHATE OF LIME. A white powder, insoluble in water, but soluble in nitric, muriatic, and acetic acids, consisting of one equivalent of phosphoric acid and three of lime, prepared by burning bones to whiteness.

BONE SPIRIT. An ammoniacal liquor obtained by the destructive distillation of bones.

BORACIC. Pertaining to or produced from borax.

BORACIC ACID. A compound consisting of boron with oxygen. It is obtained from borax by adding sulphuric acid. It has the property of rendering cream of tartar soluble in water.

BORACIC ACID SOLUBLE CREAM OF TARTAR. A preparation formed by dissolving in a silver basin at the boiling temperature, 400 parts of cream of tartar and 100 parts of boracic acid in 2,400 parts of water. The solution is kept boiling until the greater part of the water is consumed.

BORATE. A salt formed by the combination of boracic acid with a base.

BORATE OF AMMONIA. (Biborate of Ammonia.) A salt formed by dissolving boracic acid in excess in heated water of ammonia, and allowing the solution to cool slowly, when semi-transparent crystals will form.

BORAX. Biborate of soda; a salt formed by a combination of boracic acid with soda. It is brought from the East Indies, where it is said to be found at the bottom or on the margin of certain lakes. It is said to be artificially prepared in Persia, like niter. It has the property of

rendering cream of tartar soluble in water.

BORAX, ARTIFICIAL. Borax made by the direct combination of boracic acid with soda.

BORAX GLASS. The name given to borax when exposed above a red heat, being then converted upon cooling into a transparent solid.

BORAX OCTAHEDRAL. Borax crystallized into octahedrons, and containing only five equivalents of water.

BORAX, PRISMATIC. Borax crystallized into prisms, and containing ten equivalents of water.

BORBORYGMUS. A sound in the bowels, caused by gas.

BORDEAUX TURPENTINE. Common European turpentine obtained in the south of France.

BORIC ACID. An acid of boron and oxygen. It is in the form of a glassy mass decomposed only by a red heat.

BORNEO CAMPHOR. (Sumatra Camphor, Camphol.) A variety of camphor found in Borneo and Sumatra; the product of *Dryobalanops camphora*.

BORON. The radical or elementary base of boracic acid.

BORONATROCALCITE. A native borate of calcium and sodium, met with in South America, and sometimes used as a source of boron compounds.

BORURET. A combination of boron with a simple body.

BOTANY. The science which treats of the form and structure of plants.

BOTHRIOCEPHALUS. The broad tape-worm, sometimes of great length.

BOTIUM. (See *Bronchocoele*.)

BOUGIE. An instrument introduced into the urethra to expand it, or to convey a caustic to some part of its surface.

BRACHLEUS. Belonging to the arm.

BRACHIUM. (L.) The arm.

BRACHIAL. Belonging to the arm.
BRACHIATUS. Spreading in four directions.

BRAIN. The mass contained within the cranium, including cerebrum, cerebellum and medulla oblongata.

BRANDY. (*Eau de Vie.*) The spirit obtained from fermented grapes by distillation, containing from 48 to 56 per cent of absolute alcohol.

BRASS. An alloy of copper and zinc.

BRAZILIC ACID. (*Brazilin.*) An acid contained in Brazil-wood, composed of $C_{36}H_{14}O_{14}$.

BREGMA. (G.) The top of the head.

BREVIA VASA. (L. *Short vessels.*) Branches of the splenic artery and vein.

BREVIS. (L.) Short.

BRIGHT'S DISEASE. An affection of the kidneys in which the urine contains albumen—first described by Dr. Bright of London; albuminuria.

BRIM OF THE PELVIS. The bony ring between the abdominal and pelvic cavities.

BRIMSTONE. Sulphur; a hard, brittle, inflammable substance, of a yellow-lemon color, which has no smell unless heated, and which becomes negatively electric by heat and friction. It is found in great quantities, and sometimes pure, in the neighborhood of volcanoes.

BRINE. Water saturated with salt.

BRITANNIA. A metallic compound or alloy, consisting chiefly of block tin, with some antimony and a small proportion of copper and brass.

BRITISH BARILLA. (See Black Ash.)

BRITISH GUM. A substance of a brownish color, very soluble in water, formed by heating dry starch at a high temperature. Its properties are similar to dextrine.

BRITTLE GUM. (*Salabreda.*) An inferior quality of gum arabic, obtained from the *Acacia albida*.

BROMAL. An oily colorless fluid, obtained by the action of bromine on alcohol.

BROMAL HYDRATE. A salt which resembles chloral hydrate in its anæsthetic action upon the animal organism.

BROMATE. A compound of bromic acid with a base.

BROMIC ACID. An acid composed of bromine and oxygen.

BROMIDE. A compound of bromine with a metallic or basic radical.

BROMIDE OF AMMONIUM. (See Ammonia Hydrobromate.)

BROMIDE OF CARBON. An impurity which frequently exists in commercial bromine.

BROMIDE OF IRON. (*Ferri Bromidum.*) A bromide obtained by heating gently in thirty parts of water two parts of bromine and one of iron filings, filtering and evaporating to dryness in an iron vessel. It is useful in scrofulous affections.

BROMIDE OF POTASSIUM. (*Potassii Bromidum.*) A salt formed by adding to a solution of bromide of iron a solution of carbonate of potassa; carbonate of iron is formed while the bromide of potassium remains in solution, which is strained and evaporated.

BROMINE. (*Brominium, Bromum.*) An elementary substance found in sea-water and marine productions. It is a deep-red fluid, of an offensive, suffocating smell.

BROMINII CHLORIDUM. (Chloride of Bromine). A chloride prepared by passing chlorine gas through bromine and condensing the vapors which form by a freezing mixture.

BROMINIUM. (See Bromine.)

BROMOFORM. A compound closely resembling chloroform in its effects.

BROMO-PHOSPHOROUS ACID. An acid obtained by heating one molecule of phosphorous acid and two molecules of bromine in a sealed tube, at the temperature of a water-bath, until pressure is no longer observable.

BROMOPICRICN. A compound, CBr_3NO_2 , formed by slacking four parts of quicklime with fifty parts of water, transferring the mixture into a glass alembic, adding gradually six parts of bromine, then one part of picric acid, and distilling rapidly.

BRONCHIA. (*Plural Bronchia.*)
BRONCHI. (Subdivisions of the wind-pipe communicating with the lungs.

BRONCHIAL. Relating to the bronchia.

BRONCHITIS. Inflammation of the bronchiæ.

BRONCHOCELE. Enlargement of the thyroid gland.

BRONZE. A compound of copper and tin, to which other metallic substances are sometimes added, especially zinc.

BROWN SUGAR. (Unpurified Sugar.) Sugar consisting of cane sugar associated with variable quantities of hygroscopic moisture, uncrystallizable sugar, gum, albumen, etc.

BRUIT. (F.) A sound heard on percussion or auscultation.

BRUIT PLACENTAIRE. (F.) Murmuring of the uterus and placenta heard in auscultation.

BRULURE. (F.) A burn.

BRUNNER'S GLANDS. Solitary glands of the intestines.

BRUNONIAN. Following the theories of Dr. Brown.

BRUNSWICK GREEN. A compound of one part chloride of copper and three parts oxide of copper, the latter performing the office of an acid. It was used for paper-hangings and in oil paintings.

BRUNUS. Erysipelas.

BRYGMUS. Grating the teeth.

BYRONIN. A reddish, amorphous glycoside obtained from the root of the white bryony.

BUBE. A pustule.

BUBO. An inflamed gland situated in the groin.

BUBONOCELE. Rupture in the groin.

BUCCA. (L.) The cheek.

BUCCAL. Pertaining to the cheek.

BUCCEA. A mouthful.

BUCINATOR. The muscle of the cheek.

BUCCO-PHARYNGEAL. Belonging to the mouth and pharynx.

BUCNEMIA. Swelling of the leg.

BUGANTIA. Chilblain.

BULLIAT. (L.) Let it boil.

BULIMIA. An unnatural appetite.

BULLE. Large vesicles.

BULLA. A blister.

BUMPING OF FLUIDS. A term applied to the agitation of fluids in boiling. It is prevented by placing through the cork of the retort a strong glass tube with its end bent to a right angle and drawn out to a fine point.

BUNYON. An inflammation upon the great toe.

BURETTE. An instrument for dividing fluids into very small fractional parts.

BURGUNDY PITCH. (See *Abies Ecclesiæ.*)

BURNT HARTSHORN. The product resulting from exposing hartshorn to a heat sufficient to consume its animal matter.

BURMESE NAPHTHA. (Rangoon Tar.) A peculiar greenish-brown petroleum, of the consistence of goose fat.

BURNETT'S DISINFECTING FLUID. An aqueous solution of chloride of zinc, containing two hundred grains to the imperial ounce.

BURSA. A bag; a skin to spread plasters on.

BURSÆ MUCOSÆ. Mucous sacs around the joints.

BUTTER. The old name given to some of the chlorides from their soft consistency when freshly prepared.

BUTTER OF ANTIMONY. (Terchloride of Antimony.) A chloride consisting of three equivalents of chlorine to one of antimony.

BUTTER OF CACAO. The fixed oil in the kernels of the *Theobroma cacao*, used as an ingredient in ointments, for coating pills and for preparing suppositories.

BUTTER OF ZINC. (See Chloride of Zinc.)

BUTYL HYDRIDE. A constituent of American petroleum, containing ten equivalents of hydrogen and eight of carbon.

BUTYRATE OF ETHYLIC ETHER. (Butyric Ether.) A substance obtained by mixing butyric acid, alcohol and sulphuric acid. It is used for flavoring extracts.

BUTYRIC ACID. An acid produced from the fermentation of milk. (See page 261.)

BUXINA. The same as *Berberina*.

BYSSUS. A fungous growth of small cryptogamous plants occurring upon decomposing organic substances.

BYTHOS. The bottom of the stomach.

C.

C. Chemical symbol for carbon.

CA. Chemical symbol for calcium.

CACÆMIA. Bad blood.

CACHETIC. Pertaining to cachexy.

CACHEXY. A state in which the constitution is manifestly vitiated.

CACHINXATION. Loud laughter.

CACODES. Having a bad odor.

CACETHES. Of bad nature.

CACOPLASTIC. Capable of merely a low degree of organization.

CACOPHYXIA. A bad state of the pulse.

CACOTHYMIA. Derangement of the moral faculties.

CACTACEÆ. A genus of dicotyledonous monopetalous plants.

CADAVÉR. A corpse.

CADAVEROUS. Pertaining to a corpse.

CADE OIL. A kind of tar obtained by distillation from the interior reddish wood of *Juniperus oxycedrus* growing in France, where it is prepared. It is a thick, oily black liquid, smells like tar, and is used in skin diseases of horses and sheep.

CADMIA. An oxide of zinc which collects on the sides of furnaces where zinc is sublimed, as in brass foundries.

CADMI IODIDUM. (Iodide of Cadmium.) A salt prepared by mixing iodine and filings of cadmium in a moist state. It is used externally in skin diseases.

CADMI SULPHAS. (Sulphate of Cadmium.) A salt prepared by decomposing the nitrate of cadmium by carbonate of soda, forming a carbonate; this treated with dilute sulphuric acid, which expels the carbonic acid and forms the sulphate. It resembles sulphate of zinc as an astringent and emetic.

CADMIUM. A metal discovered by Stromeyer, in 1818, in carbonate of zinc. Its color is white, resembling tin. It is ductile and malleable, and when fused crystallizes in octahedrons. It melts below a red heat, and suffers but slight change in the air.

CADUCA. The deciduous membrane of the uterus.

CADUCOUS. Falling off quickly.

CÆCUM. The blind gut; name given to the first part of the great intestine.

CÆCAL. Pertaining to the cæcum.

CÆCUS. (L.) Blind.

CÆRULEAN. Blue.

CÆSAREAN SECTION. An incision through the walls of the abdomen and uterus, for the purpose of extracting the fetus.

CÆSIUM. An alkaline metal, discovered by means of spectrum analysis. In its chemical qualities the compounds of cæsium are allied to those of potassium. It colors certain lines of the spectrum a beautiful blue.

CAFFEINE. A white, bitter crystallizable substance, obtained from coffee, tea and guarana.

CAFFEOTANNIC ACID. A peculiar principle resembling tannin, found in coffee.

CAHINIC ACID. A crystallizable bitter substance believed to be the active principle of *Cahina* or Brazilian black-root.

CAJEPUT OIL. The volatile oil obtained by distilling the leaves of the *Melaleuca cajuputi*, a small tree found in the Moluccas.

CAJEPUTENE. The hydrocarbon forming cajeput oil.

CAKE COCHINEAL. An inferior variety of cochineal in flat cakes, composed of the cochineal insect mixed with portions of the thorns and skin of the cactus.

CALAMINA. (Calamine.) The native carbonated hydrated oxide of zinc, formerly regarded as a metal.

CALAMINA PREPARATA. Calamine reduced to an impalpable powder by heat.

CALAMINE. (See Calamina.)

CALAMINE, PREPARED. (See *Calamina Preparata*.)

CALAMUS. (Sweet Flag.) The root-stock of *Acorus calamus*, a wild plant found in America. It is a stimulant tonic.

CALCANEUM. A short bone situated in the lower and back part of the foot.

CALCAREO-ARGILLACEOUS. Consisting of or containing calcareous and argillaceous earth.

CALCAREO-BITUMINOUS. Consisting of or containing lime and bitumen.

CALCAREO-SILICIOUS. Consisting of or containing calcareous and silicious earth.

CALCAREO-SULPHUROUS. Consisting of or containing lime and sulphur.

CALCAREOUS. Partaking of the nature of lime; containing lime.

CALCII CHLORIDUM. (Chloride of Calcium.) A chloride formed by saturating hydrochloric acid with chalk or marble, evaporating to dryness, and heating to redness. It is used medicinally in solution only.

CALCII SULPHURETUM. (Sulphuret of Lime, Hydrosulphate of Lime.) A compound formed by passing sulphuretted hydrogen, so long as it is absorbed, through water holding lime in suspension.

CALCINATION. A term applied to the changes produced in mineral substances by intense heat, not attended with fusion, and leaving a solid residue; the term is often used synonymously with oxidation.

CALCINED. Reduced to powder by high temperature.

CALCINED MAGNESIA. Carbonate of magnesia exposed to an intense heat in an earthen vessel for two hours, or until the carbonic acid is expelled. It is an antacid and laxative.

CALCINED MERCURY. A name applied by the older chemists to red oxide of mercury.

CALCIS CARBONAS PRÆCIPITATA. (Precipitated Carbonate of Lime.) A salt formed by a precipitation resulting from a mixture of solution of chloride of calcium and a solution of carbonate of soda in water at their boiling-point.

CALCIS CHLORATÆ LIQUOR. (Solution of Chlorinated Lime.) This is prepared by mixing one pound of chlorinated lime with one gallon of distilled water by trituration in a large mortar, then passing it through a calico filter.

CALCIS CHLORIDUM. (Chloride of Lime, Hypochlorite of Lime, Bleaching Powder.) A compound resulting from the action of chlorine

on hydrate of lime as long as the former is absorbed. It is a powerful bleaching agent, also a desiccant and disinfectant.

CALCIS HYDRAS. (Hydrate of Lime, Slacked Lime.) Hydrate of lime is used exclusively as a pharmaceutical agent.

CALCIS HYPOCHLORIS. (See *Calcis Chloridum*.)

CALCIS HYPOSULPHIS. (Hyposulphite of Lime.) A salt obtained by boiling the sulphite with sulphur.

CALCIS PHOSPHAS PRÆCIPITATA. (Phosphate of Lime.) A salt prepared by dissolving the phosphate of lime in bones, with hydrochloric acid properly diluted, and precipitating it with ammonia. It is used in scrofulous affections.

CALCIS SULPHAS. (Sulphate of Lime, Gypsum, Plaster of Paris.) As *gypsum*, sulphate of lime is found in nature, combined with two atoms of water. When moderately heated, gypsum loses its water and becomes plaster of Paris. This, when moistened, takes up water again and sets to a solid mass, and is therefore much used for making casts and molds, and in dressing fractured limbs.

CALCIUM. A metal found in lime, and all calcareous substances, of a pale yellow color, malleable and ductile, melts at a red heat, and burns easily, forming lime. It decomposes water.

CALCIUM CHLORIDE. (See *Calcei Chloridum*.)

CALCIUM FLUORIDE. This compound, in solution, may be used for engraving on glass instead of hydrofluosilicic acid.

CALCIUM IODIDE. (Iodide of Lime.) A preparation formed by treating a solution of iodide of iron with milk of lime, then filtering and evaporating. It is said to be useful in phthisis.

CALCIUM OXIDE. (Pure Lime.) It is prepared by heating marble to

redness in a vessel exposed to the air; much used in mortar, cements, etc.

CALCIUM PHOSPHATE. A white granular body, crystalline, slightly soluble in water, but more soluble in water charged with carbonic acid.

CALCIUM PHOSPHIDE. A compound formed by heating lime in a Hessian crucible, and adding from time to time small portions of phosphorus, stirring well and covering after each addition, until, on taking off the cover, a blue flame appears on the surface, and remains for fifteen minutes, when occasionally stirred.

CALCIUM SULPHIDE. A compound prepared by the decomposition of gypsum by fusion with charcoal.

CALCESPAR. Crystallized carbonate of lime.

CALCULUS. (Stone, Gravel, Gall-Stone.) Any concretion accidentally formed in the bodies of animals, as in the bladder, kidneys, etc.

CALCULI. Plural of Calculus. *Arthritic Calculi* are those formed in the capsules of the joints; *Nephritic*, those formed in the kidneys, and *Urinary* those formed in the bladder.

CALDARIUM. (L.) A hot bath.

CALEFACIENT. Causing heat.

CALENDULIN. A principle of *Calendula officinalis*.

CALIBER. Diameter of any round body, as a bullet, or of a tube.

CALIGO. (L.) Blindness.

CALIPERS. Compasses with curved legs.

CALLOSITY. A hardening of the soft parts of the body.

CALLOUS. Hard; bone-like.

CALLUS. Bony matter formed during the union of fractured bones.

CALOMEL. (Subchloride of Mercury.) A well-known white compound, containing two equivalents of mercury and two of chlorine. Employed internally as purgative and vermifuge; externally applied upon venereal sores.

CALOMEL IODIDES. Compounds employed in syphilis, scrofulous and other affections.

CALOMELAS. (See Calomel.)

CALORIC. Heat; an agency to which the phenomena of heat were ascribed.

CALORIFICATION. Production of heat.

CALORIMETER. An instrument for measuring the amount of specific heat contained by any body.

CALQUOIN'S CAUSTIC PASTE. A paste prepared by combining 10 parts of chloride of zinc, 20 parts of flour, and 4 parts glycerine.

CALX. (L.) (Quicklime.) Lime freshly prepared and unhydrated.

CALX CHLORATA. } (See *Calcis*

CALX CHLORINATA. } *Chloridum.*)

CALX NATIVA. (Native Calx.) A marly earth of whitish color, which causes water to bubble and can be used like lime without calcination.

CALX VIVA. Quicklime; unslaked lime.

CAMELEON MINERAL. A compound formed by fusing together pure potash and black oxide of manganese, whose solution in water, at first green, passes spontaneously through the whole series of spectral colors to the red, and by the addition of potash returns to its original green.

CAMERA. A photographer's box.

CAMPANA. A bell.

CAMPELINA. A bandage.

CAMPHENE. A burning-fluid composed of alcohol, turpentine and camphor. This term is applied also to the pure oil of turpentine, and to a radical contained in the oil of camphor.

CAMPHOGEN. A hydrocarbon composed of eight equivalents of hydrogen and ten of carbon; the basyl of camphor.

CAMPOL. (See Borneo Camphor.)

CAMPHOR. A peculiar white, combustible, concrete substance, purified

by sublimation, derived from *Laurus camphora*, an Asiatic evergreen tree. It is a moderate stimulant, anodyne, narcotic, etc.

CAMPHOR, ARTIFICIAL. (See Artificial Camphor.)

CAMPHOR, MOTIONS OF, ON WATER. When some fragments of camphor are thrown on the surface of clean water, contained in a chemically-clean glass, they become endowed with lively motions of rotation and progression. If, while thus in motion, the water be touched with the finger, or with a speck of oil or greasy matter, the motions are immediately arrested.

CAMPHORA. (See Camphor.)

CAMPHORATE. A salt formed by the combination of camphoric acid with a base.

CANADA BALSAM. (See *Abies balsamea* and Antiseptics.)

CANADA PITCH. (*Pix Canadensis.*) The prepared concrete juice of the hemlock-spruce (*Abies Canadensis*) growing in Canada. It resembles Burgundy pitch.

CANADA TURPENTINE. (See *Abies balsamea.*)

CANAL. Any long narrow tube of the body.

CANALICULATED. Channeled. Provided with grooves.

CANALICULUS. A little canal.

CANCELLATED. Composed of cancelli.

CANCELLI. Cellular bony structures.

CANCER. A malignant tumor which disorganizes the tissues in which it is developed.

CANCERINA. Gangrene,

CANCERUM. Cancer; ulcer.

CANDIDUM OVI. (L.) The white of an egg.

CANDIED. Preserved or incrustated with sugar.

CANE BRIMSTONE. (Roll Sulphur.) A commercial term for sulphur poured into cylindrical molds.

CANE SUGAR. (Sucrose.) Sugar

obtained from the sugar-cane (*Saccharum officinarum*), beetroot, mal-low, sugar-maple, etc. It crystallizes in monoclinic prisms and is very soluble in water.

CANINE. Pertaining to the dog.

CANINE TEETH. The eye-teeth.

CANITIES. Grayness of the hair.

CANKER. Ulceration of the mouth.

CANNABENE. A colorless, volatile oil, obtained from the oil of hemp.

CANNABIN. The brown, resinous principle contained in Indian hemp (*Cannabis indica*).

CANNULA. (See Canula.)

CANTHARIDIN. A white, volatile substance, insoluble in water but soluble in oils, and forming the blistering principle of the "Spanish Fly."

CANTHOPLASTICE. The surgical formation of the angle of the eye.

CANTHUS. The angle of the eye.

CANULA. A tube of rubber, metal, etc., open at both ends, employed in many surgical operations.

CAOUTCHOUC. (Gum elastic, India Rubber.) The concrete juice of different species of *Siphonia*, a large tree growing in Brazil and Guiana. It is used for various purposes; it has been given in cutaneous disease. Products analogous to caoutchouc are yielded by many other plants.

CAOUTCHOUC VULCANIZED. (Vulcanized Caoutchouc.) Caoutchouc which has undergone the treatment of vulcanization; this consists in submitting it in thin sheets to the action of a mixture composed of forty parts bisulphuret of carbon and one of chloride of sulphur.

CAOUTCHOUCIN. A highly inflammable and very light, volatile, oily liquid, obtained by distillation from caoutchouc.

CAPHOPICRITE. A complex body obtained from rhubarb. At one time supposed to be its active purgative principle.

CAPILLARIES. Minute, hairlike tubes.

CAPILLARY. Resembling a hair; long and very slender. A fine vessel or canal, especially one of the minute vessels connecting the arteries and veins.

CAPILLARY ATTRACTION, } Terms
CAPILLARY REPULSION. } denoting the cause which determines the ascent or descent of a fluid in a capillary tube above or below the level of the surrounding fluid when the tube is dipped in that fluid.

CAPITAL. Pertaining to the head.

CAPRIC ACID. (Caprinic Acid.) An acid obtained from butter, which crystallizes in needles at 52°, and becomes entirely liquid at 64°. It has the peculiar odor of the goat, and has the formula $C_{20}H_{39}O_2$.

CAPRILIDENE. A compound of carbon and hydrogen obtained from bromated caprylene and alcoholic potassa.

CAPRINE. A neutral substance, capable of forming a soap, existing in butter.

CAPROIC ACID. An oily liquid obtained from butter, with a strong odor and a nauseous, sweetish taste.

CAPROYL HYDRIDE. A hydrocarbon obtained from purified American petroleum.

CAPSICIN. The pungent principle of cayenne pepper.

CAPSULA. A case or envelope.

CAPSULÆSEIC ACID. An acid found in the horse-chestnut.

CAPSULAR. Bag-like.

CAPSULE. A membranous covering; an evaporating dish.

CAPUT. (L.) The head.

CAPUT-MORTUUM. (L.) A word used by ancient chemists to designate the residue left in certain operations.

CARAMEL. Anhydrous or burnt sugar; a black, porous, shining substance, soluble in water, which it colors a dark brown.

CARAWAY. (*Carum*.) The fruit

of *Carum carui*. Its seeds have an agreeable odor and aromatic taste.

CARBAZOTATE OF AMMONIA. A salt formed by carbazotic or picric acid with ammonia.

CARBAZOTIC ACID. (Picric Acid, Nitropicric Acid.) An acid obtained by the action of nitric acid on indigo, silk, and other substances. It is largely used in dyeing. It may be prepared from coal-tar, creosote, or from Australian gum.

CARBO. (See Carbon.)

CARBO ANIMALIS. (Animal Charcoal, Bone Black.) Charcoal prepared from bones by subjecting them to a red-heat in close vessels. It is used chiefly in pharmacy for decolorizing vegetable principles.

CARBO ANIMALIS PURIFICATUS. (Purified Animal Charcoal.) Animal charcoal purified by the action of diluted muriatic acid.

CARBO LIGNI. (Charcoal, Vegetable Charcoal.) Charcoal prepared from wood by exposing it to a red heat without access of air. It is disinfectant and absorbent, and is chiefly used in stomach affections. The best for medicinal purposes is said to be obtained from poplar shoots.

CARBOHYDROGENS. Compounds formed by the union of carbon and hydrogen, such as olefiant gas, and light and concrete oils of wine.

CARBOLIC ACID. (See Acid, Carbolic.)

CARBON. An inodorous combustible elementary substance existing pure and crystallized in the diamond, and sometimes in graphite, and forming the basis of animal and vegetable charcoal, and of coke.

CARBON OXYCHLORIDE. (See Phosgene.)

CARBON PENTASULPHIDE. A combination formed by the action of sodium on bisulphide of carbon.

CARBON TETRABROMIDE. A compound prepared by heating bisulphide of carbon in a sealed tube with

bromide of iodine, and by other processes.

CARBON TETRACHLORIDE. (See Bichloride of Carbon.)

CARBOLATE OF QUINIA. A salt formed by the union of carbolic acid and quinia. It is used in advantage in puerperal cases and in typhus fever.

CARBONATE. A salt formed by the union of carbonic acid with a base, as the carbonate of lime, carbonate of soda, etc.

CARBONATE OF AMMONIA. (See Ammonia Carbonate.)

CARBONATE OF BARYTA. (See Baryta.)

CARBONATE OF BISMUTH. (See Bismuth Carbonate.)

CARBONATE OF IRON PRECIPITATED. (Sesquioxide of Iron, Red Oxide of Iron.) A powder employed for all the purposes to which the preparations of iron are generally applicable. It is prepared by mixing a solution of eight troy ounces of sulphate of iron in four pints of water, with nine troy ounces of carbonate of soda in four pints of water, stirring and setting aside to form a precipitate, which is washed and dried without heat.

CARBONATE OF LEAD. (*White Lead, Ceruse.*) Carbonate of lead may be prepared by passing a stream of carbonic acid through a solution of subacetate (*trisacetate*) of lead. It is employed externally in medicine only, in skin complaints.

CARBONATE OF LIME. (*Creta Chalk.*) Native friable carbonate of lime, or chalk, if pure, is entirely soluble in muriatic acid. It consists, like other varieties of chalk, of one equivalent of carbonic acid and one of lime.

CARBONATE OF LIME, PRECIPITATED. (*Calcis Carbonas Præcipitata, Creta Præcipitata.*) A salt prepared by heating separately, to the boiling-point, five pints and a half of a solution of chloride of cal-

cium and a solution of seventy-two ounces (troy) of carbonate of soda in six pints of distilled water, and mixing them.

CARBONATE OF LITHIA. A white powder, sparingly soluble in water, and having a feeble alkaline reaction. It dissolves with effervescence in dilute sulphuric acid, and forms a freely soluble salt.

CARBONATE OF MAGNESIA. (*Magnesia Alba.*) A white substance in powder or pulverulent masses, dependent for its density upon the strength of the solutions from which it is precipitated.

CARBONATE OF MAGNESIA SOLUTION. (Fluid Magnesia.) A preparation of carbonate of magnesia in the liquid form, by means of carbonic acid.

CARBONATE OF MANGANESE. A salt obtained from double decomposition of sulphate of manganese and carbonate of soda. It is used medicinally in cases of lack of appetite and chlorosis.

CARBONATE OF NICKEL. A salt obtained from *speiss*, the impure arseniuret of nickel.

CARBONATE OF POTASSA. (Salt of Tartar.) A salt which may be obtained pure from potassium tartrate. It absorbs water from the air, is very soluble, and has a strong alkaline reaction.

CARBONATE OF POTASSA IMPURE. (Potash, Pearlash.) Obtained by boiling out the ashes of plants with water, and evaporating the solution to dryness.

CARBONATE OF SODA. } (*Salt*)

CARBONATE OF SODIUM. } (*Soda.*)

A crystalline substance manufactured on an enormous scale by treating common salt with sulphuric acid, forming sodium sulphate, which is heated with coal and chalk, yielding the soda ash of commerce.

CARBONATE OF SODA, DRIED. }

CARBONATE OF SODIUM “ }

Carbonate of soda exposed, to heat

in an iron vessel until thoroughly dried, stirred constantly and rubbed into powder.

CARBONATE OF ZINC. An insoluble substance occurring native as calamine. Obtained from zinc sulphate and carbonate of soda. Formula, ZnCO_3 .

CARBONATE OF ZINC, NATIVE. (See Calamina.)

CARBONATED. Combined or impregnated with carbonic acid.

CARBONATED WATERS. Waters impregnated with carbonic acid, possessing a sparkling appearance, such as “soda water,” so called.

CARBONIC ANHYDRIDE. A colorless incombustible gas possessing the formula CO_2 . (See page 219.)

CARBONIC ACID WATER. Water impregnated with five times its bulk of carbonic acid.

CARBONIC. (Carbon Monoxide.) An inflammable, poisonous gas. (See page 219.)

CARBONIFEROUS. Producing carbon.

CARBONIZE. To change into carbon by combustion or the action of acids.

CARBOY. A large glass bottle covered with a box or basket-work to prevent breaking. Used generally for transporting strong acids.

CARBUNCLE. A painful inflammation of the fibrous tissue.

CARBURET. A combination of carbon with some other substance, the compound being neither an acid nor base.

CARBURET OF IRON. (See Black Lead.)

CARBURET OF SULPHUR. (See Bisulphide of Carbon.)

CARBURETTED HYDROGEN GAS. A name given to various gaseous hydrides of carbon.

CARCINOMA. A painful scirrhus tumor.

CARDAMON. A native plant of Malabar, *Amomum cardamomum*, bearing seeds of sharp aromatic flavor.

- CARDIA.** The heart.
- CARDIAC.** A medicine which excites action in the stomach and animates the spirits.
- CARDIALGIA.** Heart-burn.
- CARDITIS.** Inflammation of the heart.
- CARDIONCHUS.** Dilation of the heart.
- CARDOL.** A yellowish liquid obtained from the cashew-nut.
- CAREUM.** (See Caraway.)
- CARICA.** The fig.
- CARIES.** An ulcerated bone.
- CARMIC ACID.** An acid contained in cochineal.
- CARMINATIVES.** Medicines for expelling wind from the intestines.
- CARMINE.** The pure coloring matter or coloring principle of cochineal, precipitated by spontaneous evaporation from the alcoholic tincture of cochineal in the form of crystals of a beautiful red color.
- CARMINIC ACID.** A name applied to carmine in consequence of its possessing acid properties.
- CARNARY.** A receptacle for dead bodies.
- CARNEOUS.** Fleishy.
- CARNIFICATION.** Flesh-making.
- CARNIN.** One of the proximate principles of the human body.
- CARNIVOROUS.** Flesh-eating.
- CARO.** (L.) The flesh.
- CAROTIC.** Belonging to deep sleep.
- CAROTID.** The great artery of the neck. (See plate V.)
- CAROTIN.** A peculiar, crystallizable, ruby-red, neutral principle, obtained from carrot-root.
- CARPAL.** Belonging to the wrist.
- CARPUS.** (L.) The wrist.
- CARRAGEENIN.** A peculiar pectin obtained from Irish moss.
- CARTILAGE.** Solid, elastic and flexible tissues of the body.
- CARI FRUCTUS,** } (See Car-
- CARUM.** } way.)
- CARUNCLE.** A fleshy excrescence.
- CARUNCULÆ LACHRYMALES.** Small fleshy bodies situated in the inner angle of the eye.
- CARUS.** A deep insensibility, resisting the action of the strongest stimulants.
- CARVACROL.** A product obtained from oil of caraway when it is distilled with hydrated phosphoric acid, and poured back into the retort until it ceases to have the smell of caraway. It is an oily liquid, having a disagreeable odor and a strong taste.
- CARVENE.** A liquid oily hydrocarbon separable by distillation from oil of caraway, with the formula $C_{10}H_{16}$.
- CARVOL.** A liquid oil, separable by distillation from oil of caraway.
- CARYOPHYLLIC ACID.** (Eugenic Acid.) Terms applied to heavy oil of cloves, from the property it possesses of forming soluble and crystallizable salts with the alkalis.
- CARYOPHYLLIN.** A white neutral crystalline resinous substance obtained from cloves, soluble in ether and boiling alcohol.
- CARYOPHYLLUS.** The clove tree.
- CASCARILLA.** A Spanish bark used as a febrifuge.
- CASEIC ACID.** An acid derived from cheese.
- CASEIN.** The curd or the coagulable portion of milk.
- CASEOUS.** Pertaining to cheese; like cheese; having the properties of cheese.
- CASSIA BUDS.** The buds of the *Cinnamomum cassia*, a plant growing in China.
- CASSIIN.** A bitter, soluble, crystallizable principle, obtained from the root of the *Cassia fistula*.
- CASTANEA.** The chestnut.
- CASTILE SOAP.** (Spanish Soap.) A fine white or mottled soap, obtained from olive oil and soda.
- CAST IRON.** Iron containing carbon, silicon, sulphur and other impurities.

CASTOR. An animal substance secreted by glands situated under the skin of the abdomen of the beaver.

CASTORINE. An animal principle discovered in castor, prepared by boiling castor in six times its weight of alcohol and filtering the liquor.

CATACAUSIS. Spontaneous combustion of the body.

CATACLYSMA. An injection by the anus.

CATAGMA. A fracture.

CATALEPSY. A species of apoplexy.

CATALYSIS. A phenomenon occurring when a substance puts into activity, by its mere presence and without chemical union, certain affinities which without it would remain inactive.

CATALYTIC. Pertaining to catalysis.

CATAMENIA. The menses.

CATAPASM. A powder for sprinkling the body.

CATAPLASM. A soft, moist poultice applied to the body.

CATARACT. An opacity of the crystalline lens or of its capsule.

CATARRH. A severe and chronic inflammation of the mucous membrane, with an increase of its habitual secretion.

CATARRH SENILIS. Chronic bronchitis.

CATECHUIC ACID. (Catechuin.) A peculiar principle, bearing some analogy to gallic acid, of a snow-white, silky appearance, crystallizable in fine needles, fusible, soluble in boiling water, obtained from pale catechu.

CATHARSIS. Purging.

CATHARTIC. Strongly purgative.

CATHARTIN. A peculiar crystallizable principle identical with rhamnin, obtained from the fruit of *Rhamnus catharticus*.

CATHERETICS. Weak caustics, such as calcined alum, etc.

CATHETER. A tubular instrument, usually made of silver, to be introduced into the bladder to draw off

the urine when the natural discharge is suppressed; also a sound to search for stone, etc.

CATLIN. A double-edged knife.

CATOPTRIC. An examination of the eye by a lighted candle and its reflection.

CATOTICA. Disease attacking the internal parts.

CAUDEX. The stem of a plant near the root.

CAUL. The omentum covering the bowels.

CAUSTIC. A substance which placed in contact with an animal part destroys and alters its organism.

CAUSTIC COLLODION. A collodion prepared by dissolving four parts of corrosive sublimate in thirty parts of collodion.

CAUSTIC POTASSA. (Hydrate of Potassa.) A white substance, soluble in half its weight of water, acting as a powerful caustery and destroying the skin. Prepared by boiling potassium carbonate with water, and adding slaked lime. Formula, KOH.

CAUSTIC SODA. A white, solid, caustic substance, fusible below red heat, and less volatile than the potassium compound. Formula, NaOH.

CAUSTICUM COMMUNE MITIUS. (See Common Caustic, Milder.)

CAUTERIZATION. Burning or searing some part by caustic medicines.

CAVA. A large vein next to the heart.

CAVAL. Relating to the *vena cava*, the great vein of the right auricle of the heart.

CAVERNOUS. Hollow.

CAVITY. A hollow part of the body.

CEDAR. Various species of the juniper and pine.

CEDAR OIL. A volatile oil obtained from red cedar.

CEDAR, SAWDUST AND CHIPS. Used by the ancient Egyptians as a substitute for "excelsior" to fill the abdomen.

CEDAR TREE PITCH. Mentioned by Pliny as used for cheaply embalming bodies, was probably a compound of turpentine and creosote produced by distillation of the pitch pine. According to Herodotus it had a corrosive and solvent effect upon the viscera.

CEDMA. Chronic rheumatism of a joint.

CEDRAT. A species of citron tree.

CEDRIA. Cedar tree pitch.

CEDRIN. The supposed active principle of the cedron tree, growing in Central America.

CEDRIUM. Tar.

CELE. A tumor.

CELLULAR. Abounding in cells, or composed of cells.

CELLULE. A small cell.

CELLULOSE. (See Lignin.)

CELOTOMIA. A surgical operation for hernia.

CEMENT. Any glutinous or other substance capable of uniting bodies in close cohesion.

CENOTICA. Diseases affecting the fluids.

CENTIGRADE. Consisting of a hundred degrees; graduated into a hundred divisions or parts.

CENTIGRADE THERMOMETER. A thermometer having the distance between the freezing and boiling points of water divided into one hundred degrees.

CENTIGRAMME. In French weights, the hundredth part of a gramme.

CENTILITRE. The hundredth part of a litre; a little more than six-tenths of a cubic inch.

CENTIMETRE. In French measure, the hundredth part of a meter; rather more than thirty-nine hundredths of an inch, English measure.

CENTRIFUGAL. Tending to recede from the centre.

CENTRIPETAL. Tending toward the center.

CENTRUM OVALE. (L.) The appearance of the brain when a section

is made on a level with the corpus callosum.

CENTRUM TENDINOSUM. (L.) The center of the diaphragm.

CEPHALALGIA. Headache.

CEPHALE. (G.) The head.

CEPHALIC. Pertaining to the head.

CEPHALIC VEIN. A vein in the fold of the elbow.

CEPHALITIS. Inflammation of the brain.

CEPHALO-RACHIDIAN. Belonging to the head and spine.

CEPHALOTOMY. Removing the brain of the fetus in cases of difficult delivery.

CEPHALOTRIBE. An instrument for crushing the head of the fetus.

CERA ALBA. (L.) (White wax.) Yellow beeswax bleached by exposure to moisture, air and light.

CERA FLAVA. (L.) (Yellow wax.) The peculiar concrete substance or prepared honeycomb of the hive-bee, *Apis mellifica*.

CERACEOUS. Waxlike; partaking of the nature of wax.

CERASIN. A gummy substance which swells in cold water but does not readily dissolve in it. It is a proximate principle of gum, and is found in the gums exuding from the *cherry*, *apricot*, *peach* and *plum*.

CERATE. An external medication having wax and oil as its base.

CERATOCELE. Hernia of the cornea.

CERATOTOME. A knife for dividing the cornea.

CERATONIA. A genus of plants.

CERATONYXIS. Piercing of the cornea.

CERE. To wax or to cover with wax.

CERE-CLOTH. A cloth smeared with melted wax, or with some gummy or glutinous matter.

CEREALIA. Grain-bearing plants.

CEREBELLUM. The symmetrical organ situated in the lower part of the cranium; the inferior portion of the brain.

CEREBRIN. Red fatty matter of the nerve system.

CERBERUS. A mythological monster guarding the lower regions.

CEREBRITIS. Inflammation of the brain.

CEREBRUM. Upper forward portion of the brain.

CEREBRAL. Relating to the brain.

CEREBRO-SPINAL. Relating to the brain and spinal cord.

CEREVISIÆ FERMENTUM. (Beer Yeast.) The ferment obtained in brewing beer. It rises in the form of froth to the surface of beer, and subsides during the process of fermentation.

CERIUM. A metal discovered in Sweden in the mineral cerite, and so called from the plant Ceres. It is of a great specific gravity, its color a grayish white, and its texture lamellar.

CERIUM NITRATE. A salt of cerium, considered to be a nervine tonic, and useful in chronic intestinal eruction, chronic vomiting, and irritable dyspepsia.

CERIUM OXALATE. (See *Cerii Oxalas*.)

CEROMA. A fatty tumor.

CEROUS. Waxy.

CERULIN. The blue principle of indigo.

CERUMEN. Wax.

CERUMEN AURIUM. Ear-wax.

CERUSE. (See Carbonate of Lead.)

CERUSSA ACETATA. Sugar of lead.

CERVICAL. Pertaining to the neck.

CERVIX. (L.) The neck.

CERVUS. A deer.

CETACEA. The mammalian order comprising whales, etc.

CETACEUM. (Spermaceti.) A peculiar concrete substance obtained from the sperm whale. It is employed as an ingredient of ointments and cerates.

CETYL. A hypothetical carbo-

hydrogen radical composed of sixteen equivalents of carbon and thirty-three of hydrogen, bearing the same relation to ethal that ethyl bears to alcohol.

CEVADILLA. (*Sabadilla*.) The seed of a plant denominated *Veratrum officinale* and *Helonias officinalis*, growing in Mexico and the West Indies. They are a drastic emetocathartic and poisonous.

CHALCITE. Sulphate of iron of a red color, so far calcined as to have lost a considerable part of its acid.

CHALK. A well-known calcareous earth, of an opaque white color, soft, and admitting no polish. It contains a large portion of carbonic acid, and is a variety of carbonate of lime. It is used as an absorbent and antacid.

CHALK, PREPARED. (*Creta Preparata*.) Chalk freed from its impurities by washing, and dried in small masses.

CHALK STONES. Concretions occurring in the joints.

CHALYBEATE. Impregnated with iron; any preparation into which iron enters.

CHAMÆMELUM. A name given by the ancients to fresh chamomile flowers.

CHAMBER, ANTERIOR. The portion of the eye before the iris, containing aqueous humor.

CHAMBER, POSTERIOR. The portion of the eye behind the iris containing aqueous humor.

CHAMELEON MINERAL. A name by which permanganate of potassa is sometimes called.

CHAMOMILE. (*Anthemis*.) The flowers of *Anthemis nobilis*, an herbaceous European plant, growing wild in some parts of this country.

CHANCRE. A small venereal ulcer, having a tendency to spread.

CHARCOAL. The remains of wood consumed in such a manner as to exclude the air, and consisting mainly of pure carbon.

CHARCOAL, ANIMAL. (See *Carbo Animalis*.)

CHARLATAN. A quack.

CHARON. According to Greek mythology, the son of Erebus and Nox, who ferried the souls of the dead over the rivers Acheron and Styx to Hades.

CHARPIE. Lint for dressing wounds.

CHARQUI. "Jerked meat."

CHARTA. (L.) Paper.

CHAUFFER. A small furnace, open at the top, used in laboratories.

CHEILOPLASTIC. Surgical formation of the lip.

CHEILOS. (G.) The lip.

CHEIRAGRA. Gout in the hand.

CHELONION. A deformity of the spine.

CHEMISM. (See page 114.)

CHEMISTRY. The science which teaches of the nature and properties of bodies simple and compound, inorganic and organized, and investigates the force or power by which atomic combination is effected.

CHEMOSIS. An inflammation of the coat of the eye.

CHERRY LAUREL WATER. A sedative narcotic obtained from distilling of preparation of cherry laurel leaves.

CHEVASTER. A bandage for fractures.

CHIAN TURPENTINE. (*Pistacia Terebinthus*.) Turpentine obtained from a small tree, growing in Chio or Scio, by incisions into its bark. On exposure to the air it speedily thickens, and ultimately becomes concrete.

CHILBLAIN. A frost bite.

CHIMOGENE. A compound obtained from the volatile and gaseous products of petroleum.

CHINESE CAMPHOR. The cheapest and most abundant camphor, produced in the island of Formosa, and taken from thence to Canton, China.

CHINIDINE. (Quinidine.) One of the cinchona alkaloids.

CHINOIDINE. (See Amorphous Quinia.)

CHIRURGEON. A surgeon.

CHIRURGERY. Surgery.

CHITIN. A glucoside found in the wing cases of insects.

CHLORÆTHYLIDENE. An anæsthetic having the formula $C_2H_4Cl_2$.

CHLORAL. A liquid obtained by the action of chlorine gas upon alcohol. Combined with water it forms *Hydrate of Chloral*, much used as an anodyne and soporific.

CHLORATE. Chloric acid combined with some base.

CHLORATE OF POTASSA. A white salt, having the formula $KClO_3$, used medicinally for a gargle and for severe sore throat, as well as for application upon ulcers.

CHLORATE OF QUINIA. A salt formed by crystallizing a solution of chlorate of baryta with sulphate of quinine.

CHLORIC. Pertaining to or derived from Chlorine.

CHLORIC ACID. A powerfully oxidizing liquid, having the formula $HClO_3$.

CHLORIC ETHER. A solution of chloroform in alcohol.

CHLORIDE. A binary compound of chlorine with another element.

CHLORIDE OF AMMONIUM. (See Ammonia Hydrochlorate.)

CHLORIDE OF ARSENIC SOLUTION. A solution obtained from boiling together arsenious acid and hydrochloric acid.

CHLORIDE OF BARIUM. (See *Barii Chloridum*.)

CHLORIDE OF BROMINE. (See *Brominii Chloridum*.)

CHLORIDE OF CALCIUM. (See *Calci Chloridum*.)

CHLORIDE OF ETHYL. (See *Ether Muriatricus*.)

CHLORIDE OF GOLD. A metallic salt, obtained by dissolving gold in three times its weight of nitromuri-

atic acid with the aid of a moderate heat.

CHLORIDE OF GOLD AND SODIUM. A double salt, prepared by dissolving gold in nitromuriatic acid, evaporating and dissolving the dry mass in distilled water. To this solution salt is added.

CHLORIDE OF IRON. (See Antiseptics.)

CHLORIDE OF LIME. (See *Calcis Chloridum*.)

CHLORIDE OF MAGNESIUM. A bitter and very deliquescent salt, said to act mildly as a purgative, producing a flow of bile and an increase of appetite.

CHLORIDE OF SILVER. (*Argentii Chloridum*.) A salt prepared by adding a solution of common salt to a solution of nitrate of silver, as long as it produces a precipitate.

CHLORIDE OF SODA SOLUTION. *Liquor Sodæ Chloratæ*, Solution of Chlorinated Soda, Labarraque's Disinfecting Solution. (See *Liquor Sodæ Chlorinatæ*, U. S. Disp.)

CHLORIDE OF SODIUM. Common salt.

CHLORIDE OF TIN. A chloride prepared by heating tin and muriatic acid together. Recommended for local application in gonorrhœa, etc.

CHLORIDE OF ZINC. (*Zinci Chloridum*.) A salt, which may be obtained from the double decomposition between solutions of chloride of barium and sulphate of zinc. The chloride of zinc remains in solution, which is evaporated, when flaky crystals are produced.

CHLORIDE OF ZINC SOLUTION. (*Liquor Zinci Chloridi*.) Zinc dissolved by muriatic acid, and solution of chlorine added to convert any iron present into the sesquichloride, from which it is precipitated by carbonate of zinc. It is then brought to a certain bulk by the addition of water, and filtered.

CHLORINATED CHLOROHYDRIC ETHER. A compound, colorless,

neutral liquid, having an ethereal odor and hot, saccharine taste, possessing anæsthetic properties similar to chloroform.

CHLORINATED MURIATIC ETHER. (See Chlorinated Chlorohydric Ether.)

CHLORINATED SODA SOLUTION. (See Chloride of Soda Solution.)

CHLORINATED SOLUTION OF MAGNESIA. Dissolve eight ounces of Epsom salts in two pints of water; mix with four ounces of chlorinated lime and four ounces of water.

CHLORINE. An elementary gaseous fluid, of a greenish-yellow color and characteristic suffocating smell. Its specific gravity is 2.47 and equivalent number 35.5. It forms about sixty per cent of common salt, and is a powerful agent in bleaching and disinfecting.

CHLORIODIC ACID. } A compound
CHLORIODINE. } of chlorine
and iodine.

CHLORITE. A salt formed of chlorous acid and a base.

CHLOROAUATE OF AMMONIA. A salt, formed by dissolving terchloride of gold and muriate of ammonia in water, assisted by a few drops of nitromuriatic acid, and evaporating the solution to dryness.

CHLOROCARBON. A title given to the bichloride or tetrachloride of carbon. (See *Bichloride of Carbon*.)

CHLOROCARBONIC. } The terms
CHLOROCARBONOUS. } applied to
an acid composed of chlorine and
carbonic oxide, formed by exposing
a mixture of the two gases to the
direct solar rays. It has also been
called *Phosgene gas*.

CHLOROCYANIC. Composed of chlorine and cyanogen.

CHLOROCYANOGEN. A compound formed by passing a slow current of chlorine through a solution of one part hydrocyanic acid in four parts anhydrous ether.

CHLOROFORM. An oleaginous, colorless liquid, discovered in 1832.

prepared by acting upon methyl or ethyl alcohol with bleaching powder. It produces a temporary but perfect insensibility to pain. Formula, CHCl_3 .

CHLOROFORM, COMMERCIAL. (*Chloroformum Venale*, Impure Chloroform.) Chloroform containing such impurities as alcohol and ether.

CHLOROFORM, METHYLIC. Chloroform prepared by the action of chlorinated lime on pyroxylic or wood spirit.

CHLOROFORM, NORMAL. Chloroform prepared by the action of chlorinated lime on alcohol.

CHLOROFORM, VENALE. (See Chloroform, Commercial.)

CHLOROGENATE OF POTASSA AND CAFFEIN. A double salt existing in coffee.

CHLOROGENIC ACID. An acid contained in coffee. Chlorohydric acid. (See Acid, Hydrochloric.)

CHLOROHYDROCYANIC ACID. An acid having the formula $\text{C}_2\text{H}_2\text{NCl}_5$.

CHLOROMETER. An instrument for testing the bleaching qualities of chloride of lime.

CHLOROMETHYL. (See Bichloride of Methylene.)

CHLOROMETRY. Testing the bleaching qualities of chlorine compounds.

CHLOROPHYLL. A green resinoid body present in plants, soluble in ether.

CHLOROSIS. Green sickness.

CHLOROTIC. Affected with chlorosis.

CHLOROUS ACID. An unstable acid, easily decomposed. A powerful oxidizing and bleaching agent. Formula, HClO_2 .

CHLOROVALERIANIC. A compound of chlorine and valerianic acid.

CHLOROXYLIC ACID. An old term for chloroacetic acid.

CHLORSULPHOFORM. A yellowish crystalline compound, somewhat soluble in alcohol.

CHLORURET. An old term for chloride.

CHOKER DAMP. A suffocating compound of gases encountered in mines.

CHOLÆMIA. A disease caused by the entering of the taurocholates, etc., into the blood.

CHOLALIC ACID. An acid obtained by decomposing cholic or taurocholic acids by heat.

CHOLE. (G.) Bile.

CHOLECYST. The gall bladder.

CHOLEDOCHUS. That which contains the bile.

CHOLEINATE OF SODA. A natural constituent of bile.

CHOLEPYRRHIN. The coloring principle of ox-gall.

CHOLERA. A severe, rapid and dangerous disease, characterized by repeated vomiting and frequent stools.

CHOLERA INFANTUM. The summer complaint in children.

CHOLESTERIN. A fatty substance obtained from bile and biliary concretions.

CHOLIC ACID. (Glycocholic acid.) A nitrogenous acid obtained from the gall of the ox. Formula, $\text{C}_{21}\text{H}_{40}\text{O}_5$.

CHOLIN. The energetic base of ox-bile.

CHOLINIC ACID. A resinous acid obtained from bilin.

CHOLIDIC ACID. An acid obtained from cholic acid.

CHONDRIN. An animal solid resulting from the action of boiling water upon the cartilages of the ribs and joints.

CHONDRODITE. A light yellow mineral, also called *Brucite*.

CHONDROGEN. A gelatinous principle of cartilage.

CHONDROLOGY. A treatise upon cartilages.

CHONDROS. Cartilage.

CHOPIN. A French liquid measure containing about a pint.

CHORDA. A tendon.

CHORDÆ VOCALES. The vocal ligaments.

CHOREA. St. Vitus' Dance. An involuntary movement of certain organs.

CHORION. The outer envelope of the fetus.

CHORIUM. The skin.

CHOROID. Resembling the chorion. The name of certain membranes in the brain.

CHROMATE. A compound made by the union of chromic acid with a base.

CHROMATE OF POTASSA. A yellow crystalline salt obtained by fusing chrome iron ore with potassium carbonate. Formula, K_2CrO_4 .

CHROMATICS. The science of colors.

CHROME. } A hard crystalline
CHROMIUM, } metal, whose compounds are remarkable for fine bright color. It is the most infusible of all metals.

CHROME GREEN. A mixture of chrome yellow and Prussian blue.

CHROME YELLOW. (Chromate of Lead.) A yellow poisonous pigment prepared by the action of lead acetate on potassic chromate. When heated it turns brown and evolves oxygen.

CHROMIC ACID. (See Acid, Chromic.)

CHROMIUM ALUM. A compound obtained by heating together one part of bicarbonate of potassa and four of sulphuric acid. It is obtained in the manufacture of aniline dyes.

CHROMIUM SESQUIOXIDE. A powder obtained by igniting together picric acid and bichromate of ammonia.

CHROMOCYANOGENS. Compounds having chromium and cyanogen for a base.

CHRONIC. A disease of long period.

CHRSYOCOLLA. A Greek name for borax.

CHULARIOSE. (Fruit Sugar, Levulose.) Sugar as it exists in fruit. An isomeric form of glucose found in honey and the juice of fruits. It is generated from cane sugar by solution in water or weak acids, and long boiling.

CHYAZIC. A term applied sometimes to the compounds of hydrocyanic acid.

CHYLE. The white blood of the lacteals.

CHYLIFEROUS VESSELS. The lacteals.

CHYLOPOIETIC. Chyle-producing.

CHYME. The food in the intestines.

CHYMIFICATION. The conversion of food into the state of chyme.

CIBUS. Food.

CICATRIX. A scar remaining after the healing of a wound.

CICATRIZATION. Formation of a cicatrix.

CICER ARIETINUM. (L.) The chick-pea, a plant, the bristles of which contain considerable free oxalic acid.

CICUTA VIROSA. (L.) (Cowbane, Water Hemlock.) A perennial, umbelliferous European plant, proving fatally poisonous to most animals which feed upon it, though said to be eaten with impunity by goats and sheep.

CILIA. The hair of the eyelids, fine filaments resembling hairs.

CILIARY. Pertaining to the eyelashes.

CILIARY MOTION. Vibrations of cilia.

CILIUM. (L.) The eyelid or eyelash.

CILLOSIS. A spasm of the eyelid.

CINCHOLIN. (Quinolein.) An oily liquid, produced by the condensation of the acrid vapor obtained from cinchonia when heated with caustic potassa. It can also be obtained in the same manner from quinia, quinidia, and strychnia.

CINCHONA. A name given to a genus of the Peruvian bark in honor of the Countess of Cinchon. A vast number of plants belong to this genus.

CINCHONA SULPHATE. A salt obtained from the solution remaining after the crystallization of sulphate of quinia. It resembles quinine.

CINCHONIA. A crystalline substance obtained by the action of potassa upon an alcoholic extract of Peruvian bark.

CINCHONIC ACID. (Quinic Acid.) An acid contained in Peruvian bark.

CINCHONIDIA. (Cinchonidine.) An alkaloid derived from cinchonia, from which it differs in being more soluble in ether.

CINCHONIDINE. (See Cinchonidia.)

CINCHONINE. (See Cinchonia.)

CINERARY. Pertaining to or containing ashes; funereal.

CINERITIOUS. Ash-colored.

CINESIS. Motion.

CINETICA. Diseases of the muscles.

CINETUS. The diaphragm.

CINGULUM. The waist.

CINNABAR. (See Bisulphate of Mercury.)

CINNAMIC ACID. A colorless, crystalline, sourish, volatilized acid, soluble in alcohol and slightly so in water, obtained from the oil of cinnamon by the action of oxygen.

CINNAMOMUM. (Cinnamon.) The aromatic bark of *Cinnamomum Zeylanicum*.

CINNAMON LEAF OIL. A volatile oil, obtained from the leaves of cinnamon.

CIRCLE OF WILLIS. A circle at the base of the brain, formed by the anterior and posterior cerebral arteries and the communicating arteries of Willis.

CIRCULATION. The movement of fluids through the system.

CIRCULUS. A ring.

CIRRHOSIS. Yellow granulations in the liver.

CIRSOSCELE. Varicose tumor.

CIRSOPHTHALMIA. Varicose ophthalmia.

CITRATE. A salt formed by the union of citric acid with a base.

CITRENE. A crystalline compound of hydrogen and carbon, obtained from the essential oil of lemons.

CITRIC. Pertaining to the lemon.

CITRIC ACID. (See Acid, Citric.)

CITRINUS. (L.) Lemon-colored.

CIVET. (*Zybethum*.) An odorous substance obtained from the civet cat. It is insoluble in water, and is used chiefly as a perfume.

CL. Symbol for Chlorine.

CLARET. A light red French wine.

CLARIFICATION. Making clear from solid matter in suspensions. Liquids can be clarified by the addition of some coagulable substance, such as the white of an egg.

CLASSIFICATION. Methodical arrangement.

CLAUDERUS. A celebrated ancient embalmer.

CLAUSTRUM. A shutting up.

CLAVATUS. Clubbed.

CLAVICLE. The collar-bone.

CLAY. An aluminium silicate resulting from the disintegration and decomposition of felspar by the action of air and water, the soluble alkali being washed away.

CLIMACTERIC DISEASE. A change in the constitution at an advanced period in life resulting in loss of flesh and strength.

CLINIC. Instruction given in the hospital at the bedside of the patients.

CLINOID. Four processes upon the sphenoid bone.

CLOACA. The rectum of birds, reptiles and fishes—also a sewer.

CLONIC. An irregular spasm.

CLUB FOOT. A deformity of the foot.

CLYDON. Flatulence.

CLYSTER. A liquid substance injected into the intestines.

Co. Symbol for cobalt.

COADJUVANT. An ingredient in a prescription designed to aid some other ingredient.

COAGULANT. That which produces coagulation.

COAGULATE. To curdle; to change from a fluid into a fixed substance or solid mass.

COAGULATION. Changing from a liquid state to a thickened, semi-solid state.

COAGULUM. A clot or curd.

COALESCE. To grow together; to unite by natural affinity or attraction.

COAL-GAS LIQUOR. A liquor obtained in the manufacture of coal gas, from which large quantities of carbonate of ammonia are manufactured.

COALITION. Union in a body or mass; a coming together, as of separate body or parts, and their union in a body or mass.

COAL NAPHTHA. (Commercial Benzine.) A naphtha obtained by the distillation of coal-gas tar.

COAL TAR. A dark, thick liquid or semi-liquid resulting from the dry distillation of bituminous coal.

COAL-TAR ACIDS. Liquid acids, called respectively rosolic, brunolic, carbolie or phenic, acetic, and butyric. They are obtained from coal tar by distillation and rectification.

COAL-TAR ALKALOIDS. Alkaloids obtained from coal tar, called anilin, quinolin, picolin, toluidin, lutidin, cumidin, phatin, etc., etc.

COAL-TAR CREASOTE. An improper name for a number of impure liquors imported from Germany, consisting of mixtures of carbolie acid with cresylic acid, coloring matter, etc., of which the former constitutes but a small proportion.

COAPTATION. Fitting together the two ends of a broken bone.

COBALT. A metal of a reddish-gray or grayish-white color, very brittle, of a fine, close grain, compact, but easily reducible to powder.

Cocain. A peculiar alkaloid, obtained from coca.

COCCYX. The small bone at the end of the spinal column.

COCCYGEUS. Pertaining to the coccyx.

COCHINEAL. (*Coccus*.) The genus of insects *Coccus*, the dried females of which constitute the cochineal of commerce, used for red coloring. They are found wild in Mexico and Central America.

COCHLEA. The round labyrinth of the ear.

COCHLEARE. (L.) A spoon.

COCHLEARIUM. (L.) A spoonful.

COCHLEATUS. Spiral.

COCLES. (L.) One-eyed.

COCO-OLEIN. The liquid part of cocoanut oil.

COCTION. The act of boiling or exposing to heat in liquor.

CODEIA. An alkaloid existing in opium, combined with meconic acid. It is soluble in water.

CODEx. A book; a code.

CODOELLE. (See Bubo.)

CÆCUM. A pouch at the beginning of the colon.

CELLIA. The lower part of the abdomen.

CELIAC. An artery and vein of the abdomen.

CELIAC PASSION. The colic.

CELIACA. Diseases of the digestive function.

COFFIN. Derived from a Greek word which signifies a basket, coffer, or chest.

COGNAC. The best kind of brandy; so named from a town in France.

COHERE. To stick together.

COHESION. The act of sticking together.

COHESIVE. That has the power of sticking.

COHOBATE. Among early chemists, to repeat the distillation of the same liquor, or that from the same body, pouring the liquor back upon the substance contained in the vessel.

COKE. The charcoal resulting from the dry distillation of bituminous coal.

COLATOREUM. (L.) A strainer.

COLATURA. Strained fluid.

COLCOTHAR. (Polishing Rouge.) Anhydrous sesquioxide of iron. (See Fuming Sulphuric Acid.)

COLD ABSCESS. One which is the result of chronic inflammation.

COLIC. Pain in the abdomen.

COLITIS. Inflammation of the mucous membrane of the colon.

COLLAGEN. (Osseine.) A gelatinous principle, occurring in bone, animal membrane, epidermis, etc.

COLLAPSE. Failure of vital powers.

COLLATION. The act of straining or purifying liquors by passing them through a perforated vessel.

COLLICULUS. (L.) A small eminence.

COLLIQUABLE. That may be liquified or melted; liable to melt, grow soft or become fluid.

COLLIQUANT. That has the power of dissolving or melting.

COLLIQUATE. To melt or dissolve.

COLLIQUATIVE. Dissolving.

COLLISUS. Contused.

COLLI MUSCULI. (L.) Muscles of the neck.

COLLODES. Glue.

COLLODION. (*Collodium*.) A preparation formed by dissolving gun-cotton in ether, assisted by a little alcohol. It is employed for various purposes in surgery.

COLLODION, FLEXIBLE. (*Collodium Flexile*.) Made by mixing together six ounces of collodion, one hundred and twenty grains of balsam fir, and one drachm of castor oil.

COLLODION, GLYCERIZED. (Glycerized Collodion.) An elastic collodion, formed by mixing two parts of glycerin with one hundred of collodion.

COLLOIDS. A name given to a class of substances resembling glue in their power of gelatinizing.

COLLUM. (L.) The neck.

COLOGNE WATER. A solution in alcohol of various volatile odorous oils, such as oils of bergamot, orange-flower, cinnamon, etc.

COLON. The great intestine.

COLONITIS. Inflammation of the colon.

COLOPHENE. Resin oil.

COLOPHONIC ACID. An acid produced in the distillation of common yellow resin.

COLOPHONINE. An oxygenated oil, obtained by the destructive distillation of commercial rosin.

COLOPHONY. A name applied to the resin which remains after the distillation of turpentine.

COLORECTITIS. Dysentery.

COLOSTRUM. First milk of a woman who has been confined.

COLUM. (L.) A strainer.

COLUMBARIA. Plural of columbarium.

COLUMBARIUM. (L.) "A dove-cote." Among the Romans, a building provided with niches for the reception of cinerary urns.

COLUMBATE. A compound of columbic acid with some base.

COLUMBIC ACID. A white, flaky acid obtained from columbo root, soluble in alcohol, slightly so in water and ether.

COLUMBIUM. An exceedingly rare metallic element, discovered by Hatchett in 1801, in a mineral called columbite.

COLUMNA. (L.) A pillar.

COLUTORIUM. (L.) A gargle.

COLZA OIL. A liquid obtained from *Brassica campestris*, used for soap-making.

COMA. An abnormal stupor.

COMATOSE. In a state of stupor.

COMBINATION. Intimate union or association of two or more particles; chemical union; union by affinity.

COMBINE. To unite by affinity or chemical union.

COMBUSTIBLE. A substance that will take fire and burn; a body which, in its rapid union with others, disengages heat and light.

COMBUSTION. The union of inflammable substances with oxygen, attended with light and in most instances with heat; the disengagement of heat and light which accompanies chemical combination.

COMBUSTION, SPONTANEOUS. The igniting arising from chemical combination without external agency.

COMMA BACILLUS. A species of microbe, so named from its resemblance in form to a comma; supposed to be the cause of the Asiatic cholera.

COMMERCIAL CHLOROFORM. (See *Chloroformum Veuale*.)

COMMERCIAL MURIATIC ACID. (Impure Muriatic Acid.) Muriatic acid containing such impurities as sulphurous and sulphuric acid, free chlorine, nitrous acid, etc., etc.

COMMERCIAL SULPHATE OF IRON. (Copperas, Green Vitriol.) Sulphate of iron, containing such impurities as sesquioxide of iron, copper, zinc, alumina, magnesia, etc., etc.

COMMI. The outside bandages which surround an Egyptian mummy are made of cotton cloth soaked in *commi* an unknown kind of resin.

COMMUNUTED. Triturated; pulverized.

COMMUNUTED FRACTURE. Breaking of a bone into small splinters.

COMMUNUTION. The act of reducing to a fine powder; pulverization.

COMMISSURE. A point where two parts join together.

COMMIX. To mix; to blend.

COMMIXTION. A mixture.

COMMIXTURE. The mass formed by mixture.

COMMON CAUSTIC. Milder. (*Caustic Commune Mitius*.) A preparation made by evaporating a solution of potassa to one-third, and adding lime enough to form a firm paste.

COMMON SALT. (See Chloride of Sodium.)

COMMON WATER. (*Aqua*.) A term applied to rain, snow, spring, river, well, lake, and marsh waters, of which the *rain* and *snow* are the purest.

COMPATIBLE. That can be mixed without mutual interference.

COMPLEX. Resulting from several different things being brought together.

COMPLEXUS. (L.) A surrounding.

COMPLICATED FRACTURE. A fracture attended with dislocation or injury of a joint.

COMPOSITION. The combination of different substances, or substances of different natures, by affinity; from which results a compound substance, differing in properties from either of the component parts.

COMPOSITUS. Compound.

COMPOUND. A mixture formed by the union of two or more ingredients.

COMPOUND FRACTURE. A fracture attended with laceration by the end of the bone.

COMPRESSES. Pieces of soft linen or sponge used in dressing wounds.

COMPRESSIBILITY. The quality of bodies by virtue of which they can be made to occupy a smaller space. Gases are the most compressible, and obey the law of Boyle, that the volume varies inversely as the pressure.

COMPRESSOR. Name given to muscles which press certain parts together.

CONCENTRATE. To increase the specific gravity of a substance; to make stronger.

CONCEPTACULUM. (L.) A receiver.
CONCEPTION. Impregnation of the ovum.

CONCHA. (L.) A shell.

CONCOCTION. Old term for digestion.

CONCREMENT. A growing together; the collection or mass formed by concretion or natural union.

CONCRESCENCE. Growth or increase; the act of growing or increasing by spontaneous union or the coalescence of separate particles.

CONCRETE. To congeal, to thicken, to coagulate. A compound; a mass formed by concretion.

CONCRETION. Growing together; a calculus.

CONCUSSION. A blow caused by falling.

CONDENSATION. Making more dense or compact. Bringing the component parts of a gas or vapor nearer one another by pressure or cold.

CONDENSER. A vessel in which vapors are reduced to a liquid form.

CONDENSATION. Diminution of volume.

CONDENSER. An instrument for compressing vapor.

CONDIMENT. Seasoning.

CONDITURA. The embalming of the dead.

CONDUIT. A canal.

CONDYLE. A bony projection.

CONDYLOID. Wart-like.

CONFECTION. A pulpy preparation of powdered substances mixed with syrup or honey.

CONFLUENT. Running together.

CONFORMATION. Natural arrangement of different parts of the body.

CONGEAL. To change from a liquid to a solid state as in freezing; to grow stiff or thick.

CONGELATION. Changing a liquid to a solid.

CONGENITAL. Existing at the time of birth.

CONGESTION. Accumulation of blood in an organ.

CONGESTIVE. Arising from congestion.

CONGLOBATE. Gathered into a ball.

CONGLOMERATE. Blended together.

CONGLUTINATE. To unite by adhesion.

CONIA. (Coniine.) The active principle of hemlock leaves.

CONICUS. (L.) Conical.

CONIFERIN. A principle resembling salicin, discovered in the bark of turpentine trees.

CONJUNCTIVA. A mucous membrane uniting the globe of the eye to the lids.

CONJUNCTIVITIS. Inflammation of the conjunctiva.

CONJUNCTUS. (L.) Joined together.

CONNATE. Congenital.

CONNECTIVE TISSUE. The most common of all the organic tissues, constituting the net-work which connects the minute parts of most of the structures of the body.

CONOID. Cone-shaped.

CONSECUTIVE. Following after; secondary.

SENSUS. The sympathy existing between different parts of the body.

CONSERVE. A mixture of fresh vegetable substances with sugar.

CONSISTENCE. } Degree of near-

CONSISTENCY. { ness or union between the molecules of a body which causes the body to resist in a greater or less degree the forces tending to divide it.

CONSPICUOUS. A theory, view or plan.

CONSTIPATION. Retention of the feces within the rectum.

CONSTITUENT. The principal ingredients in a compound.

CONSTITUTIONAL. Hereditary, of acquired predisposition; involving the whole system.

CONSTRICTIVE. Stopping the flow of blood; astringent.

CONSTRUCTOR. That which binds together.

CONSTRINGENT. A medicine possessing the quality of contracting, binding, or compressing.

CONSULTATION. A gathering of physicians about a sick person to deliberate upon means of cure.

CONSUMPTION. A wasting disease of the lungs.

CONTAGION. The spreading of disease by contact.

CONTAGIOUS. Capable of causing contagion.

CONTAGIOUS SYMPATHY. Diseased organs affecting adjacent structures without direct continuity.

CONTINUITY. Direct connection.

CONTINUOUS SYMPATHY. Propagation of disease along a continuous surface.

CONTINENT. Chaste.

CONTORTION. Twisting.

CONTRA-APERTURE. A counter-opening.

CONTRACTILITY. The inherent quality by which fibers contract in one direction and broaden in another.

CONTRACTION. Drawing together; mutual approach of the molecules of any body.

CONTUSION. A bruise.

CONVALESCENCE. A period between the cessation of disease and the recovery of the normal powers.

CONVALESCENT. Recovering.

CONVECTIVE. Carrying.

CONVERGENT. Turned inward.

CONVEX. Rising or swelling into a spherical or rounded form.

CONVEXITY. Rotundity.

CONVOLUTE. Rolled upon itself.

CONVOLUTED. Twisted.

CONVOLUTIONS. Windings.

CONVULSION. Violent contraction of muscles.

COPAL. A concrete resinous juice which exudes from several trees in the East Indies. It is a hard, shining transparent, citron-colored and

inodorous substance, which resembles amber. In solution, diluted with turpentine, it forms a varnish.

COPHOSIS. Deafness.

COPPER. (*Caprum.*) A metal of a pale red color, tinged with yellow. Next to gold, silver, and platinum, it is the most ductile and malleable of the metals, and it is more elastic than any metal except steel.

COPPERAS. (See Commercial Sulphate of Iron.)

COPULA. A ligament.

COPYOPIA. Dimness of sight.

COR. (L.) The heart.

CORACOID. Shaped like a crow's beak.

CORALLIUM. (L.) Coral.

CORALLOID. Coral-like.

CORDA. (*Chorda.*) A cord.

CORDA TYMPANI. (L.) A nerve of the ear. (*Chorda Tympani.*)

CORE. The pupil of the eye.

CORETOMIA. An operation for an artificial pupil.

CORIACEOUS. Leather-like.

CORIUM. Skin; leather.

CORNEA. The thickest of the coats of the eye.

CORNEITIS. Inflammation of the cornea.

CORNU. (L.) A horn.

CORNU CERVI. (L.) Hartshorn.

CORNUTUS. (L.) Horn-shaped.

COROLLA. Petals of a flower.

CORONA. The crown of the head.

CORONOID. Shaped like a crow's beak; a process of the jaw, etc.

CORPORA. (L.) Bodies.

CORPORA MALPIGHIANA. (L.) Dark points in the kidneys.

CORPULENT. Fleshy.

CORPUS. (L.) A body.

CORPUS CAVERNOSUM. (L.) Erectile spongy tissue.

CORPUSCULE. An atom.

CORRIGENT. Substances added to a medicine to make it more mild or modify its action.

CORROBORANT. Strengthening.

CORRODE. Literally "to eat away." Destroying the texture of a

body, more especially of a living body, as by the mineral acids and caustic alkalies.

CORROSIVE. That which corrodes or devours a substance.

CORROSIVE SUBLIMATE. (See Bichloride of Mercury.)

CORRUGATION. Wrinkling of the skin.

CORRUGATOR. A muscle which causes wrinkling.

CORTEX. Bark; rind.

CORTICAL. Pertaining to or resembling bark.

CORUNDRUM. A hard mineral.

CORYPHE. The point; extremity.

CORYZA. Catarrhal inflammation of the mucous membrane.

COSMETIC. A preparation for beautifying the skin.

COS SIS. A small pimple.

COSTAL. Pertaining to the ribs.

COSTALIS PLEURA. That part of the lining of the thorax beneath the ribs.

COSTIVENESS. An unnatural detention of fecal matter in the bowels.

COSTOXIPHOID. The name of a ligament uniting the cartilage of the seventh rib to the xiphoid cartilage.

COTYLOID. Shaped like a cup.

COUCHING. An operation for catarract.

COUMARIN. The active constituent of the Tonka bean.

COUNTER IRRITATION. Irritation in some part of the body for the purpose of relieving excitement in another part.

COUNTER EXTENSION. Applying force in an opposite direction while tension is being made in reducing dislocations.

COUP. A stroke; a blow.

COURSES. The menses.

COURT-PLASTER. A plaster made by applying to silk of various colors, by means of a brush, first a solution of isinglass and afterward a solution of benzoin.

COUVRE CHEF. (F.) A bandage for the head.

COWPER'S GLANDS. Two small glands in the vicinity of the prostate gland.

COXA. (L.) The hip.

COXALGIA. Pain in the hip.

COXARIUS MORBUS. (L.) Hip disease.

CR. Symbol for chromium.

CRANIUM. The skull.

CRANIOLOGY. The science of skulls; phrenology.

CRANIOSCOPY. Inspection of skulls.

CRASSAMENTUM. Clot or coagulum.

CREAM OF TARTAR. (See Acid Tartrate of Potash.)

CREAM OF TARTAR, SOLUBLE. A preparation formed by boiling six parts of cream of tartar and two of borax in water, and filtering to separate the tartrate of lime.

CREASOTE. (*Creasotum*.) A peculiar substance, obtained from wood tar by distillation. It is an oily, colorless liquid, having the smell of smoke, often called *oil of smoke*.

CREASOTE WATER. (*Aqua Creasoti*.) Mix and agitate, till the solution is perfect, one drachm of creasote with one pint of distilled water.

CREATIN. A crystalline, soluble organic base, obtained from the juice of flesh.

CREATININ. A crystalline soluble product of the dehydration of creatin; one of the constituents of urine. Formula, $C_4H_7N_3O$.

CREMASTER. Suspensory muscle of the testis.

CREMATION. The burning of the dead.

CREMATORY. A building containing a furnace for cremation.

CREMOR. An oily substance floating upon the surface of a liquid.

CREMOR TARTARI. (See Acid Tartrate of Potash.)

CRENATUS. (L.) Wavy, notched.

CREPITANT. Making a crackling sound.

CREPITATION. Crackling.

CREPITUS. (L.) A rattling or crackling sound; the grating of the ends of broken bones.

CREST OF THE ILIUM. Upper edge of the pelvis.

CREST OF THE TIBIA. The forward edge of the large bone of the lower leg.

CRESYL. A fetid substance existing in carbolic acid in the sulphuretted state.

CRESYLIC ACID. A principle contained in coal tar, closely analogous to carbolic acid.

CRESYLIC ALCOHOL. A principle in coal tar which adheres tenaciously to carbolic acid, and causes it to become brown on exposure to the air.

CRETA. (L.) Chalk.

CRETA PREPARATA. (L.) Obtained by mixing powdered chalk with water, and drying the sediment.

CRETACEOUS. Resembling or containing chalk.

CRETINISM. An idiotic affection, sometimes hereditary, developed in certain localities, often in connection with the goitre.

CRIBRATUS. (L.) Perforated like a sieve.

CRIBRIFORM. Sieve-shaped.

CRICO-ARYTENOID. } Muscles
CRICO-PHARYNGEAL. } of the
CRICO-THYROIDES. } throat.

CRICOID. Ring-like; a cartilage at the lower part of the larynx.

CRIMNODES. Resembling bran.

CRINONES. Grubs.

CRINUS. (L.) The hair.

CRISIS. A critical change in the course of a disease.

CRISTA. (L.) A crest.

CRISTA GALLI. Cockscorn; a process of the ethmoid bone.

CRITICAL. Pertaining to a turning-point; decisive.

CROTCHET. An instrument for removing a fetus.

OROTALUS. The rattle-snake.

CROTON TIGLIUM. A small tree or shrub, growing in the East Indies,

the seeds of which constitute the main supply of the croton oil of commerce.

CROUP. Inflammation of the trachea.

CRUCIAL. Cross-like.

CRUCIAL LIGAMENTS. Ligaments in the knee-joint.

CRUCIBLE. An earthen or metal vessel placed in the fire in order to fuse refractory substances.

CRUDE. Rough; not changed from its natural state.

CRUDE PYROLIGNEOUS ACID. Impure acetic acid obtained from the distillation of wood.

CRUOR. The red part of the blood.

CRURA. (L.) The legs.

CRURAL. Pertaining to the leg or thigh.

CRURAEUS. } Muscles and nerves

CRURALIS. } of the leg.

CRUS. (L.) The thigh.

CRUSTA. A shell; scum.

CRUSTA LACTEA. Milk-scab.

CRUSTACEA. Shell-fish.

CRYOPHORUS. An instrument for determining the amount of cold produced by evaporation.

CRYPT. A subterranean cell; especially a vault under a church, used for burial purposes.

CRYPTAE. (L.) Pits; concealed mucous follicles.

CRYPTOPHANIC ACID. An organic dibasic acid, found in urine.

CRYSTAL. An inorganic body, which, by the operation of affinity, has assumed the form of a regular solid, terminated by a certain number of plane and smooth surfaces.

CRYSTALLINE. Clear; pellucid; a name given to the lens of the eye.

CRYSTALLIZATION. Solidifying of liquids in regular forms.

CRYSTALLIZE. To cause to form crystals.

CRYSTALLOGRAPHY. Science of the form and structure of crystals.

CRYSTALLOIDS. A name applied

to all crystallizable substances which are highly diffusible.

CRYSTALS OF TARTAR. (Cream of Tartar.)

CRYSTALS OF VENUS. A name applied to the neutral acetate or crystallized acetate of copper.

CU. Symbol for copper.

CUBIC NITRE. (Nitrate of Soda.) A salt obtained by treating carbonate of soda with nitric acid. Found native in Peru. Formula Na NO_3 .

CUBITAL. Pertaining to the forearm.

CUBITUS. The fore-arm.

CUBOIDES. Cube-shaped. A bone in the ankle.

CULTURE FLUID. A fluid prepared for the cultivation of bacteria.

CURCURBIT. A cupping-glass.

CULEX. (L.) A gnat.

CULINARY. Pertaining to the kitchen.

CUNEIFORM. Wedge-shaped.

CUNEIFORM BONES. Bones of the ankle.

CUPEL. A shallow cup.

CUPELLATION. Refining metals in a cupel.

CUPPING. Drawing blood by scarifying and the use of cupping-glasses.

CUPPING-GLASS. A glass vessel, like a cup, to be applied to the skin before and after scarification for drawing blood.

CUPRI ACETAS. (L.) See Acetate of Copper.)

CUPRI NITRAS. (L.) (Nitrate of Copper.) A salt employed as a caustic in severe cases of ulceration of the throat and tongue.

CUPRI SULPHAS. (Sulphate of Copper, Blue Vitriol.) A brilliant blue salt obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution to crystallization.

CUPRO-SULPHATE OF AMMONIA. A double salt, obtained by dropping a solution of pure ammonia into a

solution of sulphate of copper until the subsalt first thrown down is dissolved; then concentrating and precipitating by alcohol.

CUPRUM. (L.) (See Copper.)

CUPRUM ALUMINATUM. (*Lapis Divinus, Pierre Divine.*) A preparation formed by mixing, in powder, three ounces each of sulphate of copper, nitrate of potassa, and alum, heating the mixture in a crucible so as to produce watery fusion; then mixing in a drachm of powdered camphor.

CUPRUM AMMONIATUM. (L.) (Ammoniated Copper.) A crystalline violet-colored powder with a sharp taste, used as tonic and astringent. Prepared from blue vitrol and carbonate ammonia.

CUPULA. The cup of the acorn.

CUPULIFERAE. The oak and chestnut families of trees.

CURA. Cure; care; treatment.

CURATIVE. Health-restoring.

CURD. Thickened milk.

CURCULIS. The throat.

CURCUMA. Turmeric.

CURETTE. An instrument with a spoon-shaped end, for extracting foreign substances from the bladder, etc.

CURVATIVE. A deviation from a straight line.

CUSPIDATI. Canine teeth; eye-teeth.

CUSPIS. A point.

CUSTOS. (L.) A guard.

CUTANEOUS. Pertaining to the skin.

CUTICLE. Epidermis; the defensive covering of the true skin.

CUTIS ANSERINA. (L.) Goose-skin.

CUTIS VERA. (L.) The true skin.

CYANATE. A saline compound of cyanic acid with a base.

CYANHYDROCHLORIC ACID. A crystalline compound, odorless, of a saline taste, soluble in water, alcohol and glacial acetic acid, but rapidly changed in these solutions.

CYANIC ACID. A compound of cyanogen and oxygen.

CYANIDE. A basic compound of cyanogen with some other element or compound.

CYANIDE OF ETHYL. (See *Æther Hydrocyanicus*.)

CYANIDE OF GOLD. A salt employed in syphilis and obstinate ulcers.

CYANDIDE OF MERCURY. (See Bicyanide of Mercury.)

CYANIDE OF POTASSIUM. (Cyanuret of Potassium.) A cyanide obtained by passing a current of strongly heated nitrogen over charcoal, impregnated with carbonate of potassa. It is very poisonous, acting like prussic acid as a poison and as a medicine.

CYANIDE OF SILVER. (See *Argenti Cyanidum*.)

CYANIDE OF ZINC. (*Zinci Cyanidum*.) A cyanide precipitated as a white insoluble powder, by adding a solution of cyanide of potassium to a solution of sulphate of zinc until it ceases to produce a precipitate.

CYANOSIS. } A blue or livid

CYANOPATHY. } coloring of the skin attendant upon certain diseases.

CYANOGEN. A compound acidifying and basifying principle, composed of one equivalent of nitrogen and one of carbon. It is a gas, which has an odor like that of crushed peach-leaves, and burns with a rich purple flame.

CYANURET. A basic compound of cyanogen and some other element or compound.

CYANURET OF ETHYL. (See *Æther Hydriocyanicus*.)

CYANURET OF GOLD. (See Cyanide of Gold.)

CYANURET OF MERCURY. (See Bicyanide of Mercury.)

CYANURET OF POTASSIUM. (See Cyanide of Potassium.)

CYANURET OF SILVER. (See *Argenti Cyanidum*.)

CYANURIC ACID. A crystallizable acid obtained by decomposing urea by heat.

CYATHUS. (L.) A wine-glass.

CYCLISCUS. A lozenge.

CYEMA. The ovum.

CYICOES. Pertaining to the dog.

CYMENE. A constituent of coal tar.

CYMOL. A product of the oxidation of oil of cumin.

CYNANCHE. A kind of angina.

CYNANHICUS. A remedy for quinsy.

CYNOLYSSA. Hydrophobia.

CYNOPHORIA. Pregnancy.

CYNOREXIA. Canine appetite.

CYPHOSIS. Abnormal curvature of the spine.

CYPRIAN TURPENTINE. The turpentine of the ancients; an opaque, greenish-yellow thick substance with the odor of fennel.

CYST. A bladder or sac.

CYSTEOLITHOS. Stone in the bladder.

CYSTIRRHAGIA. Hemorrhage from the bladder.

CYSTIRRHŒA. Catarrh of the bladder.

CYSTITIS. Inflammation of the bladder.

CYSTOPLASTY. Cure of fistulous openings in the bladder by adhesions.

CYSTOPTOSIS. Relaxation of the internal membrane of the bladder.

CYSTOSPASTIC. Spasm of the bladder.

CYSTOTOMIA. Cutting into the bladder.

CYSTOPLEGIA. Paralysis of the bladder.

CYTOBLAST. A cell-germ.

D.

DACRYOMA. (G.) Weeping from the eyes, or a flow of tears.

DAMMAR. A resin extracted from an East India tree allied to the pine.

DARTOS. The second layer or tunic of the scrotum whose contraction depends upon its muscular fibers.

DARTRE. (F.) A general name given to all eruptions of the skin.

DATURA STRAMONIUM. "James-town weed," or stramonium. (See Poisons.)

DATURIA. An alkaloid of *Datura stramonium*.

DECALITRE, OR DECALITER. A French measure containing 10 litres, or about 2 gallons.

DECANT. To pour off gently a clear fluid so as not to disturb the sediment below.

DECANTATION. The act of pouring off as above.

DECARBONATE. To deprive a carbonate of its carbonic acid.

DECIDUA. A porous membrane formed inside of the womb at the time of conception.

DECIDUOUS. Falling off early.

DECIGRAMME. A French weight of one-tenth of a gramme, or about $1\frac{1}{2}$ grains.

DECOCTA. (L.) Decoctions.

DECOCTION. The act of boiling, or the thing prepared by boiling.

DECOLLATION. Decapitation.

DECOLORIZE. To bleach, or deprive of color.

DECOMPOSE. To separate into constituent or simpler parts.

DECOMPOSITION. A breaking up or dissolution of chemical affinity, hence frequently used for putrefaction.

DECORTICATE. To strip off the bark, or outer covering.

DECREPITATION. A crackling sound produced by roasting with a strong heat such substances as common salt.

DECUBITUS. A lying down, or reclining.

DECUMBENT. Lying down, or reclining.

DECUSSATION. A crossing, like an X, usually applied to nerve fibers.

DEFECATE. To purify or refine in chemistry.

DEFECATION. Outside of chemical use, usually applied to the act of emptying the bowels of feces.

DEFIXUS. Impotent.

DEFLAGRATE. To burn with a sudden, bright flame.

DEFLORATION. To deflower, or deprive a maiden of her virginity.

DEFORMATION. (L.) A deformity.

DEGLUTITION. The act of swallowing.

DEGMUS. A gnawing pain.

DEHISCENT. Gaping, applied to plants.

DEJECTIONS. Beside the ordinary use of this word it is applied to the stools, or motions of the bowels.

DELIBLE. Able to be blotted out or destroyed.

DELIGATION. The application of a ligature or bandage.

DELIQUATE. } To gradually melt

DELIQUESCE. } by the absorption of moisture from the atmosphere.

DELIQUESCENT. Thus melting, or spontaneously becoming liquid.

DELIQUIUM. (L.) Syncope, or faintness.

DELIRIUM. Incoherent talk with more or less persistent derangement of mind.

DELIRIUM TREMENS. (L.) "Trembling delirium," a name given on account of its prominence as a symptom to alcoholic mania (*Mania a potu*).

DELPHINIA. An alkaloid obtained from the plant larkspur.

DELTOID. Triangular; name given to a muscle of the shoulder.

DEMENTIA. Idiocy.

DEMI. (F.) Half.

DEMONOMANIA. A variety of monomania in which the victim is tormented by the idea of being possessed by a demon.

DEMULCENT. Softening, or soothing, and hence applied to medicines designed to lessen irritation of any kind.

DENARCOTIZE. To deprive of narcotic properties as denarcotized laudanum.

DENGUE. (Sp.) An infectious fever, generally seen in warm countries.

DENSITY. In Physics the proportion of quantity of matter to its bulk, or volume.

DENTAGRA. (L.) Toothache.

DENTAL. Pertaining to the teeth.

DENTATUS. The second cervical vertebra.

DENTIFRICE. A tooth-wash.

DENTINE. The ivory of the teeth.

DENTITION. The phenomena of the cutting and development of the teeth.

DENTOIDOUS. Like a tooth.

DENUATION. Removal of natural covering.

DEOBRUENT. Removing obstructions.

DEODORIZED. Deprived of its odor.

DEOXIDATE. To deprive of oxygen.

DEPHLEGMATIOM. The process of removing water from spirits or acids, by evaporation or distillation.

DEPILATORY. Any substance used to remove superfluous hair.

DEPLETION. Diminution of the quantity of fluid in a living body.

DEPLUMATION. Falling off of the eye-lashes.

DEPRESSION. A pressing down of the surface.

DEPRESSOR. A muscle which presses down the part on which it acts.

DEPURATING. Purifying.

DERANGEMENT. Functional disturbance of the organs.

DE RASIERE. One of the most noted of the earlier embalmers.

DERIVATIVE. Revulsive, or counter-irritant.

DERMOID. Resembling, or belonging to the skin.

DESICCANT. A medicine that dries, or deprives of moisture.

DESICCATION. Drying. (See Putrefaction.)

DESMA A bandage, or ligament.

DESMOBACTERIA. Straight, cylindrical cells, usually much longer than wide, usually united in chains.

DESMOID. Resembling a ligament.

DESPUMATE. To froth, or foam.

DESPUMATION. Clarification of a liquid by the removal of its foam.

DESQUAMATION. Scaling, or exfoliation as of the skin.

DESUDATIO. (L.) Profuse sweating.

DESULPHURATE. To deprive of sulphur.

DETERMINATION. Excessive flow of blood to any part or organ.

DETERSIVE. Having cleansing power.

DETONATION. A sudden explosion, or report made by the union of combustible bodies.

DETRITUS. (L.) Fragments, or debris.

DETRUSOR URINÆ. The muscles of the bladder which expel from it the urine.

DEUTO. A prefix signifying two, as in the obsolete word deuto-hydroguret, for which bi-hydride is now generally used.

DEUTOXIDE. Is a binoxide, or one containing two atoms of oxygen.

DEVAPORATION. The change of water into vapor.

DEXTRAL. Right handed.

DEXTRIN. Soluble starch, or British gum produced by heating starch to about 150° C.

DEXTRO-TARTARIC ACID. Tartaric acid which has the power of turning to the right the plane of polarization of polarized light.

DI. Prefix signifying *two* or *twice*.

DIA. Prefix signifying *through*.

DIABETES. A disease of the kidneys, characterized by sugar in the urine.

DIACAUSIS. Excessive heat.

DIACODIUM. Syrup of poppies.

DIAGNOSIS. The determining and distinguishing of disease.

DIAGNOSTIC. Characteristic of a disease.

DIALURIC ACID. An acid obtained by decomposing alloxanthin.

DIALYSIS. A method of separating mixed substances based upon the difference in diffusibility between certain liquids.

DIALYZED FERRIC OXIDE. A preparation of hydrated iron, used as an antidote for arsenic.

DIAMOND. The hardest of known bodies, consisting of pure carbon crystallized in a regular octahedron.

DIAMMONIC CARBONATE. A compound prepared by macerating ammonium carbonate in liquor ammonia.

DIAPASM. A powder or perfume.

DIAPHANOUS. That can be seen through.

DIAPHORESIS. Extreme perspiration.

DIAPHORETIC. A medicine inducing perspiration.

DIAPHRAGM. The great muscle separating the chest from the abdomen.

DIAPHRAGMATIC. Pertaining to the diaphragm.

DIAPHRAGMITIS. Inflammation of the diaphragm.

DIAPHTHORA. (G.) Corruption.

DIAPYEMA. Suppuration.

DIARRHŒA. A disease characterized by fluidity of the alvine discharges.

DIARTHROSIS. A movable articulation.

DIASTASE. A nitrogenous substance produced in malt, tending to hasten the formation of sugar.

DIASTASIS. Extension of a broken limb.

DIATHESIS. Morbid habit.

DIAZOBENZOLE. An explosive compound prepared from hydrochlorate of anilin, muriatic acid and nitrate of soda.

DICHASTASIS. A spontaneous subdivision.

DICHLORACETIC ACID. An acid formed by treating acetic acid with chlorine.

DICHLORPHENOL. A compound formed by passing chlorine gas through phenol.

DICHOTOMOUS. Dividing into two branches.

DICHOISM. The phenomenon presented by certain crystals which appear of different colors when viewed from different directions.

DICROTIC. Double pulsation.

DIDYMIUM. A rare metal.

DIES. (L.) A day.

DIET. Food.

DIETETICS. Relating to the food.

DIFFUSATE. Water impregnated with crystalloid matter.

DIFFUSE. Spreading.

DIFFUSIBLE. Having the property of spreading.

DIGASTRIC. Two bellied.

DIGEST. To convert food into blood; to soften and prepare by heat.

DIGESTER. A vessel contrived to increase the solvent power of water.

DIGESTION. Conversion of food into blood. The action of liquids upon medicines.

DIGESTIVE. Aiding digestion.

DIGITAL. Pertaining to the fingers.

DIGITUS. (L.) A finger.

DIGITUS PEDIS. A toe.

DILATATION. A widening or expanding.

DILATE. To make wider.

DILATOR. Name of certain muscles.

DILUENT. That which weakens, thins, or makes more liquid.

DILUTE. To make weaker by the addition of fluid.

DIMORPHOUS. Having crystals of two different forms.

DINUS. Giddiness; vertigo.

DIPLOE. Spongy tissue separating the two tables of the skull.

- DIPLOPIA.** Double vision.
- DIPPEL'S ANIMAL OIL.** An oil obtained in distilling bones.
- DIPSOMANIA.** A violent desire for intoxicating liquors.
- DIPSOSIS.** Excessive thirst.
- DIRIGENT.** Directing.
- DISCOLOR.** To tinge or stain.
- DISCRETE.** Separated.
- DISCUSSION.** Dispersion.
- DISCUTIENT.** A remedy to disperse a tumor, etc.
- DISEASE.** A morbid state; opposed health.
- DISENGAGE.** To free; to liberate.
- DISINFECTANT.** Neutralizing contagious effluvia.
- DISINFECTING FLUIDS.** (See Selected Formulas.)
- DISINTEGRATION.** The separation of the integral parts of a substance.
- DISLOCATION.** A putting out of joint.
- DISORGANIZATION.** Destruction of an organ by disease.
- DISOXIDATE.** To free from oxygen and thereby change from the state of an oxide.
- DISPENSARY.** A place for distributing medicines. A charitable medical institution.
- DISPENSATORY.** A book treating of medicines and their preparation.
- DISSECTION.** Separating with the knife for anatomical study.
- DISSOLUTION.** Death; the act of dissolving or liquefying.
- DISSOLVE.** To change from a solid to a liquid state.
- DISTAL.** In the direction of the extremity.
- DISTENSION.** Dilatation.
- DISTILL.** To convert into vapor by heat; and condense that vapor by cold.
- DISTILLATE.** The product of distillation.
- DISTILLATION.** Volatilizing by heat, and subsequent condensation.
- DISTOMA.** Having two mouths.
- DISTORTION.** A twisting to one side.
- DISULPHATE.** A sulphate containing two equivalents of sulphuric acid.
- DISULPHURET.** A sulphuret having two equivalents of sulphur to one of a base.
- DITHIONATE OF SODA.** Hyposulphite of Soda.
- DIURESIS.** An abundant flow of urine.
- DIURETIC.** A medicine increasing the secretion of urine.
- DIVERTICULUM.** (L.) A blind tube branching from a longer tube.
- DOGMATICS.** An ancient school of physicians.
- DOLICHOS PRURIENS.** (L.) Cowitch, a plant.
- DOLOR.** (L.) Pain; suffering.
- DOLOROUS.** Painful.
- DONOVAN'S SOLUTION.** A solution of iodide of arsenic and iodide of mercury, used in cutaneous affections.
- DORSAL.** Pertaining or belonging to the back.
- DORSO-CERVICAL.** Pertaining to the back of the neck.
- DORSUM.** (L.) The back.
- DOSE.** The quantity of medicine to be taken at one time.
- DOTHEN.** A boil.
- DOUBLE AQUAFORTIS.** Nitric acid of one-half concentrated strength, specific gravity, 1.36.
- DOUCHE.** A column of liquid directed upon some part of the body.
- DRACHM.** Sixty grains, or the eighth part of an ounce.
- DRAGON'S BLOOD.** (*Sanguis Draconis.*) A resinous substance obtained from several species of calamus growing in the East Indies.
- DRASTIC.** An energetic purgative.
- DRAUGHT.** Amount of liquid swallowed at a dose.
- DRIED SULPHATE OF IRON.** (See *Ferri Sulphas Exsiccata.*)

DROPS. A drop of liquid is generally considered equal to a minim or the sixtieth part of a drachm; the number of drops varies much according to the nature of the liquid.

DROPSY. A morbid accumulation of water into any of the cavities of the body.

DROSOMETER. An instrument for measuring the amount of dew.

DRUGS. Original materials from which medicines are prepared.

DRUPA. (L.) A fruit containing a stone, as the peach.

DRY CUPPING. Cupping without scarification.

DRYING OIL. Oil deprived of its unctuous quality.

DUCT.) A canal in the body for
DUCTUS.) conveying fluids.

DUCTUS AD NASUM. (L.) A canal from the lachrymal sac to the nose.

DUCTUS PANCREATICUS. (L.) A canal leading from the pancreas to the duodenum.

DULCE. (L.) Sweet.

DULCIFICATION. Making sweet.

DULCIFIED SPIRIT. A compound of mineral acids with alcohol.

DUODENITIS. Inflammation of the duodenum.

DUODENUM. First portion of the small intestine.

DUPLICATE. Doubled.

DUPLICATURE. Doubling back of a membrane upon itself.

DURA MATER. (L.) The outer membrane of the brain.

DURAMEN. The heart of a tree.

DUST. To sprinkle with a powder.

DYNAMIC. Possessing force; vital.

DYNAMIS. Power or faculty.

DYS. A prefix meaning *difficult*.

DYSCOPHOSIS. Hardness of hearing.

DYSENTERY. Inflammation of the mucous membrane of the lower intestines.

DYSLYSIN. (See Chemistry of the Human Body.)

DYSMENORRHEA. Painful menstruation.

DYSOPIA. Impaired sight.

DYSPOMIA. Weakened sense of smell.

DYSPEPSIA. Difficulty of digestion.

DYSPNEA. Difficult breathing.

DYSTHETICA. A bad state of body.

DYSTOCHIA. Difficult labor.

DYSURIA. Painful urination.

E.

EARTH. By the alchemists used to express one of the supposed four elements. Later defined as any tasteless, odorless, unimflammable, and infusible body, and in modern chemistry restricted to oxides of ten metals, but five of which, alumina, glucina, yttria, zircona and thorina fulfill the definitions as the others, lime, baryta, strontia, etc., are strongly alkaline.

EAU. (F.) Water. (See Eau de Javelle, Antiseptics.)

EAU DE COLOGNE. (F.) Cologne water.

EAU DE LUCE. (F.) A strong solution of ammonia scented with oil of amber and mastic.

EAU DE VIE. (F.) Brandy.

EBRIETY. Giddiness and drunkenness.

EBULLITION. Boiling.

EBURNATION. The state of being hard like ivory.

ECBOLIC. Inducing abortion or facilitating labor.

ECCHYOMA. A soft blue swelling after a bruise.

ECCHYOSIS. (Pl. ses.) Same as ecchymoma.

ECCYESIS. Extra uterine pregnancy.

ECLAMPSIA. Convulsions of infancy or child bed.

ECLECTIC. Claiming to choose from all and to be confined to no

single system either in philosophy or medicine.

ECONOMY. Literally "household order," and hence the term animal economy is used to denote the sum total of the parts which constitute a living body.

ECPHLYSIC. A vesicular eruption.

ECPHRONIA. Melancholia, insanity.

ECPHYAS, OR ECPHYMA. An excrescence on the skin.

ECPYESIS. A general name for pustular eruptions.

ECRASEUR. (F.) A steel chain gradually tightened by a screw, and used for minor operations.

ECSARCOMA. A fleshy excrescence.

ECSTASY. Suspension of sensibility and voluntary motion, usually with the absorption of the mind upon a single idea. Trance.

ECTHYMA. An eruption of pustules without fever.

ECTOPIA. Displacement, as ectopia cordis or misplacement of the heart.

ECTOZOON. (Pl. zoa.) Parasitic animals which infest the surface of the body.

ECTROPION. Eversion of the eyelid.

ECZEMA. Literally a "boiling up," applied to a very common vesicular eruption which oozes fluid and forms a yellowish scab.

ECZEMATOUS. Belonging to, or like eczema.

EFFERENT. Carrying off or away, applied to vessels or nerves passing away from an organ. (See *Vasa efferentia*.)

EFFERVESCENCE. A boiling over, usually applied to the rapid escape of a gas from a liquid.

EFFETE. Past bearing, worn out.

EFFLORESCENCE. Flowering; applied in chemistry to a formation of powder upon the surface of crystals from the escape of their water of

crystallization; also bright redness of the skin.

EFFLUVIUM. (Pl. via.) Sickly exhalation arising from marshy ground, and also applied to morbid odors from any body.

EFFUSION. The escape of any fluid from its natural vessel, a pouring out.

EGESTA. The natural excretions of the body.

EGG. A mass formed in the ovary and containing the germ of animal life together with liquids necessary to its nutrition for a certain length of time.

EGG NOG. A drink made from spirits and sugar combined with the yolks of eggs beaten with sugar and the whites of eggs.

EGLANTINE. (Sweet Brier.) A species of rose upon which a kind of insect produces the *fungus rosarum*.

EGYPTIAN OPIUM. An opium adulterated with gum arabic.

ELAIDIC ACID. An acid formed by the saponification of elaidin with the alkalis.

ELAIDIN. A fatty matter resembling stearin. (See Chemistry of the Human Body.)

ELAIN. The liquid portion of animal fat.

ELASTICIN. (See Chemistry of the Human Body.)

ELCOSIS. Ulceration.

ELECTIVE. Selecting certain kinds of substances in combination.

ELECTRIC. Pertaining to electricity.

ELECTRIC CALAMINE. (See Calamine.)

ELECTRICITY. A form of force in nature produced from a disturbance of molecular equilibrium, and manifesting itself in various ways.

ELECTRO-CHEMISTRY. The science which treats of the chemical changes produced by electricity.

ELECTRODE. A pole of a galvanic battery.

ELECTROLYSIS. Decomposition

of a compound by an electric current.

ELECTROLYTE. A compound subject to electrolysis.

ELECTROMETER. An instrument to measure electricity.

ELECTRO-PUNCTURE. Plunging needles which are connected with a galvanic battery into the soft parts of the body.

ELEMENT. One of the simple constituents of any form of matter.

ELEMENTARY. Containing but one element.

ELEMI. A fragrant resin.

ELEOPTENE. Fluid principles of volatile oils partially congealed.

ELEPHANTIASIS. A disease characterized by great swelling of the legs.

ELEVATOR. That which lifts up; a name given to certain muscles.

ELIQUATION. Separating the parts of a compound by applying sufficient heat to fuse one of the components.

ELIXATION. Boiling.

ELUTRIATE. To purify by washing with water and decanting the water containing impurities.

EMBALMING. (From *em* and *balsamum*, "balsam.") The art of preparing dead bodies, chiefly by the use of chemicals, in order to preserve them from putrefaction and the attacks of insects. By some it is thought to have originated from burying bodies in sand impregnated with natron and other salts which preserved the bodies, and suggested imitation of the process by artificial methods.

EMBOLE. The process of reducing a dislocation.

EMBONPOINT. (F.) Fullness of the healthy body.

EMBROCATION. A liniment to be rubbed upon the affected part.

EMBRYO. The fetus before the fifth month.

EMBRYOLOGY. Description of the fetus.

EMESIS. Vomiting.

EMETIC. Producing vomiting.

EMETO-CATHARTIC. A medicine causing vomiting and purging.

EMISSARIUM. A canal for fluids.

EMISSION. The act by which matter is thrown from the body.

EMOLLIENT. Softening; an external application designed to relax or soften parts which are inflamed or too tense.

EMPASM. A powder sprinkled upon a body to remove offensive odors.

EMPHRACTIC. A medicine which closes the pores of the skin.

EMPHLYSIS. Vesicular eruptions.

EMPHYMA. A tumor below the skin.

EMPHYSEMA. A swelling produced by gas.

EMPIRIC. One who follows experience alone, as distinguished from those who proceed according to recognized general principles.

EMPIRICAL. Based upon experience alone.

EMPLASTRUM. A plaster.

EMPYEMA. Collection of pus in the cavity of the thorax.

EMPYESIS. Suppuration.

EMPYREUMATIC OILS. Oils obtained by distillation from the decomposition of vegetable or animal substances.

EMULSION. A milk-like mixture, containing oil and water united by some third medium.

ENAMEL. The hard outer surface of the teeth.

ENARTHROSIS. Ball and socket joints.

ENCAUMA. A scar left by a burn.

ENCEPHALIC. Within the head.

ENCEPHALITIS. Inflammation of the brain.

ENCYSTED. Inclosed in a sac.

ENDEMIC. Prevailing within a particular region.

ENDERMATIC. Applied to the skin.

ENDOSMOSIS. Passage of liquids or gases through membranes.

ENDOTHELIUM. A tubular system formed of a single layer of flat cells; the essential constituent of the blood-vessels.

ENEMA. An injection into the rectum as a medicine or for nourishment.

ENGORGEMENT. Accumulation of fluid in hollow organs.

ENNUI. (F.) Listlessness.

ENSIFORM. Sword-shaped.

ENTASIS. Tonic spasm.

ENTERIC. Pertaining to the intestines.

ENTERITIS. Inflammation of the bowels.

ENTEROPATHIA. A disease of the intestines.

ENTOMOLOGY. Natural history of insects.

ENTOZOA. Small parasites.

ENURESIS. Inability to retain urine.

EPHEMERA. Lasting but a day.

EPHIALTES. Nightmare.

EPIDEMIC. A disease extending over a wide district.

EPIDERMIS. The outer or scarf skin covering the true skin.

EPIDERMIC. Relating to the epidermis.

EPIGASTRIC. Above the stomach.

EPIGLOTTIS. A fibro-cartilage at the upper part of the larynx behind the tongue.

EPILEPSY. A convulsive disease accompanied with lividity of the face, foaming at the mouth, and stupor.

EPIPHYSIS. A bony process attached by cartilage.

EPIPLOON. (See Omentum.)

EPISPASTIC. Blistering.

EPITHELIUM. The covering of the mucous membrane, analogous to the endothelium.

EPSOM SALTS. (Sulphate of Magnesia.) A cathartic salt originally prepared from boiling the mineral waters at Epsom, England.

EQUIVALENCE. (See page 119.)

ERBIUM. A rare metal.

ERECTILE TISSUE. A tissue which is susceptible of dilatation and rigidity.

EREMACAUISIS. Slow combustion from oxygen of the air.

ERETHISM. Irritation of an organ.

ERODED. Worn; ragged.

ERRATIC. Irregular.

ERUCTATION. Belching. Emission of wind from the stomach.

ERUPTION. Pimples upon the skin.

ERYSIPELAS. A disease characterized by inflammation of the skin, fever, and tension of the part affected.

ERYTHEMA. Redness.

ESCHAROTIC. A caustic producing a scar.

ESCULAPIUS. (*Æsculapius*.) The god of medicine, usually represented as an aged man accompanied by a serpent.

ESCULENT. That may be eaten for food.

Eso. A prefix signifying *internal*.

ESOPHAGUS. (See Esophagus.)

ESSENCE. The principal qualities of a plant or drug extracted from superfluous matter.

ESSENTIAL. Pertaining to an essence.

ESSENTIAL OIL. A volatile oil, to which plants owe their peculiar odor.

ESSENTIAL SALT OF LEMONS. A name given to the quadroxalate of potassa.

ETHAL. A principle obtained by the saponification of spermaceti.

ETHER. (*Æther*, Sulphuric *Æther*.) A mobile, volatile, colorless liquid obtained from heating together alcohol and sulphuric acid.

ETHER, ACETIC. An ether formed by distilling alcohol with acetic acid and sulphuric acid.

ETHER, HYDRIODIC. An ether prepared from alcohol, iodine and phosphorus.

ETHER, HYDROCYANIC. An ether prepared from sulphovinate of baryta and cyanide of potassium.

ETHER, MURIATIC. An ether prepared from muriatic acid and alcohol.

ETHER, PURE. Pure ether, having a specific gravity of 0.713.

ETHER, SULPHURIC. (See Ether.)

ETHERIZATION. The effects produced by the inhalation of ether.

ETHYLAMIN. A volatile alkaloid.

ETHMOID. Sieve-like; a bone of the head.

ETIOLOGY. The science of the causes of disease.

EUCALYPTOL. An antiseptic essential oil obtained from the large leaves of the Australian tree *Eucalyptus*.

EUSTACHIAN TUBE. A canal leading from the throat to the internal ear.

EUTROPHIC. Increasing nutrition.

EVAPORATE. To pass off and disappear in the form of vapor.

EVERSION. A turning outward.

EVOLUTION. Development.

EXACERBATION. Exhibition of violent symptoms.

EXAERESIS. Removing or amputating a part.

EXANGUIOUS. Bloodless.

EXANTHEMA. A rash, or eruption of the skin.

EXCIPIENT. An inert, harmless substance, such as simple syrup, used as a vehicle for administering medicines.

EXCISION. Cutting out.

EXCITANT. Stimulant; arousing the vital activity.

EXCITEMENT. Stimulation.

EXCITO-MOTORY. The true spinal nerves.

EXCORIATION. A wounding which removes the skin.

EXCREMENT. The feces.

EXCREMENTITIOUS. Of the nature of excrements.

EXCRESCENCE. An abnormal growth upon the surface of organs or on the skin.

EXCRETION. Anything thrown off.

EXCRETORY. Designed for transmitting discharges.

EXFOLIATION. The separation of dead bone in the form of scales.

EXHALATION. The throwing off of vapor.

EXHAUST. To draw off completely.

EXHILARANTS. Stimulants.

EXHUMATION. Disinterment of the dead.

EXOPHTHALMIA. Protrusion of the eye-ball.

EXOSMOSIS. That property by which rarer fluids pass through membranes into denser liquids.

EXOTIC. Belonging to a foreign country.

EXPECTORANT. A medicine promoting the discharge of mucus from the air passages.

EXPIRATION. The act of expelling the air from the lungs.

EXPLORATION. Probing a wound or examining the body by the various instruments of precision.

EXPLOSIVE. Capable of detonating, or exploding.

EXPRESSED OILS. Oils which are extracted by means of pressure.

EXPULSIVE. Pressing, or driving out.

EXSANGUINATED. Deprived of blood.

EXSICCATION. A thorough drying.

EXSTROPHY. The eversion or placing on the surface of the body of an organ, as the bladder.

EXTENSION. Stretching out; hence applied to the force used in reducing and keeping in a place a fracture or dislocation.

EXTENSORS. Muscles whose function is to extend the limbs, etc.

EXTIRPATION. The complete removal of any part of the body.

EXTRACTION. Drawing out; hence used in chemistry to denote the removal of any part of a compound

by means of the proper solvent, as extraction by water, alcohol, ether, etc.

EXTRACT. Is that which is thus drawn out.

EXTRACTIVE MATTER. A name formerly given to a mixture of proximate principles, which have the property of becoming gummy during the evaporation of fluids in which they are dissolved.

EXTRANEUS. Foreign to the body.

EXTRA-UTERINE. Outside of the uterus. (See Abdominal Pregnancy.)

EXTRAVASATION. The effusion of blood beneath the skin, or outside of its natural channels.

EXTREMITIES. The ends; hence the limbs are frequently so called.

EXTORSAL. Turned outward.

EXUDATION. The passage of any liquid through a membrane, usually applied to the passage of the liquor sanguinis through the walls of the blood vessels.

EXUVIÆ. (L.) Literally shells, but also applied to any effete matter.

EYE-BALL. The globe of the eye.

EYE-TEETH. The upper canines, so called because their roots extend upwards toward the eyes.

F

F. Symbol for Fluorine; also for Fahrenheit, which see.

FABA. (L.) A bean.

FACETTE. (F.) A small smooth surface.

FACIAL. Belonging to the face.

FACTIVA. Earliest name given to bacteria.

FÆCES. (L.) Dregs. (See Feces.)

FAHRENHEIT'S THERMOMETER. The one in ordinary use in the United States. The freezing point in this scale is placed at 32°, and the boiling point for water at 212°. Zero

Fahrenheit, therefore is 32° below freezing instead of indicating the freezing point as it does on the centigrade thermometer.

FALCIFORM. Scythe-shaped, so named from Latin word *falx*, a scythe.

FALLOPIAN TUBES. Those passing from the womb to the ovaries.

FALLOPIUS. One of the most famous of earlier anatomists, after whom the Fallopian tubes are named.

FARCY. A disease of the lymphatics of the skin of the horse.

FARINA. Fine flour made from winter wheat.

FARINACEOUS. Floury, or like farina.

FASCIA. (L.) Literally a bandage, hence applied to certain of the ligaments and sheaths of the body. As *fascia lata*, *transversalis*, etc.

FASCICULAR. In bundles, or fibers.

FAUCES. (L.) The pharynx and back part of the mouth.

FAVUS. (L.) Like a honey-comb.

FAVUS. A skin disease with honey comb like crusts.

FE. Symbol for iron. (See Chemistry.)

FEBRICULA. (L.) A slight or transient fever.

FEBRIFUGE. A medicine to drive away fever.

FECAL. Belonging to the feces, or excrements.

FECES. (*Fæces*.) The evacuations of the bowels.

FECULA. The grounds or sediment of a liquid, and also starch and starch-like bodies, insoluble in cold water, but soluble in hot, with which it forms a glutinous solution.

FECUNDATION. The act of impregnation, or rendering fruitful.

FEL BOVINUM. (L.) Ox gall.

FELLINIC. Belonging to bile, as fellinic acid, which is prepared from bilin by the action of muriatic acid.

FELON. An inflammation of the

finger where the effusion is below the periosteum.

FEMORAL. Belonging to the thigh, as the femoral artery. (Plate III.)

FEMUR. The thigh-bone.

FENESTRA. (L.) A window; name given to openings in the internal ear.

FENESTRATED. Having windows or openings.

FERMENT. That which produces fermentation, for varieties of which, and causes, see Section IV.

FERMENTUM. (L.) Yeast.

FERRATED. Containing iron.

FERRIC ACID. According to the former nomenclature prepared by passing chlorine through a concentrated solution of potash holding hydrated iron in suspension.

FERRO. A prefix signifying iron from the Latin name for the same (*ferrum*).

FERRUM. (L.) Iron. Usually found in the genitive case with the ending "i," *e. g.*:

FERRI ARSENIAS. (Arsenate of iron).

FERRI CHLORIDIUM. (Chloride of iron.)

FERRI FERROCYANIDUM. (Prussian Blue.)

FERRI RUBIGO. (Iron rust.)

FERRI SULPHAS. (Ferrous sulphate), etc., etc., etc.

FERVOR. Violent heat.

FETID. Having an offensive odor.

FEVER. A systemic disease, characterized by disturbance of the sympathetic nervous system, increased heat, rapid pulse etc.

FIAT. (L.) Let there be made.

FIBER or FIBRE. Delicate filaments, or thread-like portions into which various animal and vegetable tissue can be broken up.

FIBRIL. A small filament or fiber.

FIBRIN. A white, stringy material, obtained from coagulated blood.

FIBROUS. Composed of fibers.

FIBULA. (L.) The smaller bone of the lower leg.

FIBULAR. Relating to the fibula.

FICUS. (L.) The fig.

FILAMENT. A small fiber.

FILIFORM. Thread-like.

FILLET. A small band.

FILM. A thin skin or membranous covering.

FILTER. A strainer of some porous material, such as unsized paper, sand or charcoal, through which a liquid is passed for clarification.

FILTRATE. Fluid which has been clarified by passing through a filter.

FILTRATION. Passing through a filter.

FILUM. (L.) A thread.

FIMBRIA. (L.) A fringe.

FIR. (*Pinus Abies*.) A tree which yields tar and turpentine.

FIRE DAMP. Light carburetted hydrogen; an explosive gas encountered in mines.

FISH GLUE. (*See Isinglass*.)

FISSURE. (*Fissura*.) A narrow crack in a bone.

FISUS. (L.) Cloven.

FISTULA. A sinuous ulcer in the form of a narrow canal.

FIXED BODIES. Those which are vaporized with great difficulty.

FIXED OILS. Oils which are but slightly vaporized by the action of heat.

FLACCID. Soft and weak; relaxed.

FLAGELLUM. (L.) The motive, ciliary organ of certain bacteria, by which they whip themselves forward.

FLAKE. A loose scale-like mass.

FLASK. A thin, narrow-necked vessel for fluids.

FLATULENCE. Wind in the stomach and bowels.

FLAVESCENT. Yellowish.

FLAVUS. (L.) Yellow.

FLAX. (*Linum Usitatissimum*.) A common annual plant from whose seeds is obtained linseed oil.

FLAXSEED MEAL. (Linseed Meal.) Ground flaxseed.

FLEXION. Bending.

FLEXOR. That which bends; name applied to certain muscles of the joints.

FLINT GLASS. A clear, refractive glass which contains oxide of lead.

FLOCCILATION. Picking at the bed-clothes.

FLOCCULENT. Flaky.

FLOODING. Hemorrhage of the uterus.

FLORAL. Belonging to flowers.

FLOUR OF MEAT. A preparation of meat dried so as to lose its water and ground to fine powder.

FLOWERS. A name given to certain sublimated products as the flowers of sulphur, zinc, etc.

FLUCTUATION. The undulation of a fluid within the body.

FLUID. A body whose particles easily move about and which is capable of flowing. Applied both to liquids and gases.

FLUOBORIC ACID. An acid consisting of fluorine and boron.

FLUOMANGANIC ACID. An acid obtained from hydrofluoric acid and perchloride of manganese.

FLUOPHOSPHATE. A compound containing fluorine and phosphoric acids united with some base.

FLUOR. (L.) A flow.

FLUORIC. Obtained from fluor-spar.

FLUORIDE. A compound of fluorine with a base.

FLUORIDE OF AMMONIUM. A compound by which glass can be etched.

FLUORIDE OF SODIUM. A compound obtained from fluoride of calcium, carbonate of lime, sulphate of soda and carbon.

FLUORINE. An element occurring in quartz and in minute quantities in animal substances, which has never been isolated. Symbol F.

FLUOR SPAR. (Calcium Fluoride.) A mineral occurring in cubic crystals, found in Derbyshire, England, and used as a flux in the reduction of metals. Formula, CaF_2 .

FLUOSILICATE. A compound of fluosilicic acid with a base.

FLUOSILICIC ACID. An acid composed of fluorine and silicon.

FLUX. A flow; a substance introduced during the reduction of metallic compounds to assist in the removal of foreign matter.

FLUX, DEFLAGRATING. A mixture of charcoal and nitre, used for substances insoluble in water.

FÆNICULUM. Fennel; an aromatic plant.

FÆTAL. Pertaining to the foetus.

FÆTUS. (L.) A young animal before birth.

FOLIATION. Forming into leaves, or presenting a leaf-like appearance.

FOLIUM. (L.) A leaf.

FOLLICLE. A small capsule or opening.

FOMENTATION. The application of warm lotions or medicated liquids.

FOMITES. (L.) Producers of contagious diseases.

FONTANEL. Apertures in the skulls of infants where the sutures join.

FORAMEN. (L.) A small opening.

FORCEPS. Pincers.

FOREARM. The arm between the elbow and wrist, containing the radius and ulna.

FORENSIC. Pertaining to courts of law, or criminal procedure.

FORMICA. (L.) An ant.

FORMIC ACID. (See page 260)

FORMULA. An expression, by letters and figures, of the composition of a substance.

FOSSA. (L.) A depression or shallow groove.

FOSSIL. Dug from the earth.

FOWLER'S SOLUTION. A preparation of arsenious acid and bicarbonate of potassa to which is added spirit of lavender. It has the general action of arsenic.

FRACTURE. A breaking.

FRANGIPANNI. A perfume ob-

tained from the flower of a West Indian tree.

FRANKINCENSE. (See Olibanum.) The names is applied in modern times to the concrete fragrant juice of the *Thus Americanum*, etc.

FRAXIN. A principle obtained from the bark of the ash tree, *Fraxinus excelsior*.

FREEZING MIXTURE. A compound for producing intense cold, such as a mixture of ice and salt.

FREEZING POINT OF WATER. That degree upon the scale of the thermometer at which water begins to freeze. Upon the ordinary scale this is at 32 degrees; upon the Centigrade and Réaumur thermometers at 0 degrees.

FREMITUS. (L.) A shuddering or trembling.

FRENCH CHALK. A variety of indurated talc, chiefly used for marking cloth.

FRENCH VINEGAR. (Wine Vinegar.) A vinegar prepared from white or red wine which is much stronger than malt vinegar.

FRENCH WHITE. Pulverized chalk.

FRIABLE. Easily reducible to powder; crumbling.

FRICTION. The rubbing of one substance against another producing heat.

FRIGIDITY. Coldness.

FRIGORIFIC. Producing cold.

FRIGUS. (L.) Cold.

FRONS. (L.) The forehead.

FRONTAL. Pertaining to the forehead.

FRUCTIFICATION. The forming or bearing of fruit.

FRUCTOSE. An uncrystallizable sugar occurring already formed in honey and certain fruits.

FRUCTUS. (L.) Fruit.

FRUMENTUM. (L.) Grain.

FUCUS. A seaweed yielding iodine.

FUGACIOUS. Fleeting; of short duration.

FULIGINOUS. Sooty.

FULLER'S EARTH. A friable clay, unctuous to the touch, of various colors.

FULMINATING. Detonating or exploding with a loud report.

FUMARIC ACID. An acid obtained from certain species of fungi.

FUMIGATING PASTILES. Small cones made of fragrant materials which on being burned yield an agreeable odor in a sick room.

FUMIGATION. Exposing to smoke to free from contagion.

FUMING. Giving off vapor when exposed to the air.

FUMING SULPHURIC ACID. A kind of sulphuric acid obtained from distillation of green vitriol or ferrous sulphate.

FUNCTION. The action of an organ or set of organs.

FUNDAMENT. The anus.

FUNDUS. (L.) The base or bottom.

FUNERAL URN. A vase used by the ancients to receive the ashes after cremation.

FUNGI. Plural of fungus, which see.

FUNGIC ACID. (Fumaric Acid.)

FUNGOUS. Spongy, soft, and of sudden growth.

FUNGUS. (Plural, Fungi.) A mushroom; a large order of cryptogamous plants which grow on dead and decaying organic bodies and infest living plants. Some are useful for food and medicine, some violently poisonous.

FUNIS. (L.) The umbilical cord.

FUNICULUS. A small cord.

FURFURACEOUS. Bran-like.

FUROR. Violent madness.

FUSCINE. A dark colored substance obtained from certain animal oils.

FUSE. To melt by heat.

FUSEL OIL. An oily, poisonous liquid produced in the manufacture of potato oil. (See Amyl Alcohol.)

FUSIBLE. Capable of liquification by heat.

FUSION. The act of making liquid by applying heat.

FUSTIC. A yellow dye-stuff.

G.

G. Symbol for glucinum.

GABBERA. A name given to mummies by St. Augustine.

GALA. (G.) Milk.

GALACTIC. Pertaining to milk.

GALACTOMETER. An instrument for determining the quality of milk.

GALBANUM. A gum-resin obtained from the *Ferula galbaniflua*.

GALEN. A noted physician of antiquity.

GALENA. Native sulphuret of lead; the ore from which lead is obtained.

GALL. Bile.

GALLATE. A salt formed by the combination of gallic acid with some base.

GALL BLADDER. Receptacle for bile under the liver.

GALLEY. A long furnace containing a row of retorts whose necks protrude through openings in the side.

GALLIC. Derived from gall-nuts.

GALLIC ACID FERMENTATION. A property possessed by galls of turning tannic acid into gallic acid.

GALL NUTS. (Galls.) Excrescences formed upon a kind of oak tree from punctures of certain insects. They are powerfully astringent.

GALLON. A measure of quantity, containing four quarts. The standard U. S. gallon contains 231 cubic inches, the beer gallon 282 cubic inches.

GALVANIC. Pertaining to galvanism.

GALVANISM. Electricity developed from chemical action and not from friction.

GALVANIZED IRON. Iron upon which a coating of metallic zinc has been deposited.

GALVANO-CAUSTIC. Relating to the employment of galvanic heat as a caustic.

GAMBOGE. A cathartic gum-resin.

GANGLION. (Plural, Ganglia.) An enlargement upon a nerve, resembling a knot.

GANGRENE. Mortification.

GAS. An aeriform, elastic fluid expanding definitely by heat, and reducing its volume under pressure.

GASEOUS. Of the nature of gas; aeriform.

GAS LIQUOR. The ammoniacal liquor condensed in the manufacture of coal gas, from which sal-ammonia is obtained.

GASOMETER. A reservoir for gas.

GASTER. (G.) The stomach.

GASTRIC. Pertaining to the stomach.

GASTRIC JUICE. The peculiar juice secreted by the stomach for digesting food.

GASTRITIS. Inflammation of the stomach.

GASTROTOMY. Incision through the stomach.

GELATIN. A colorless transparent substance soluble in hot water, and found in the skin and membranes of animals; animal jelly.

GELINE. A name given by Gannal to compounds formed by aluminium salts with the albuminoids of the body; when submitted to the action of boiling water it forms gelatin.

GENERA. (Plural of Genus.)

GENITAL. Pertaining to procreation.

GENU. (L.) The knee.

GENUS. (Plural, Genera.) A family; a group of nearly-related species.

GERANIUM. (Crane's Bill.) A species of plants.

GERANIUM, ROSE. A fragrant plant whose odor depends upon its

volatile oil which is used to adulterate oil of roses.

GERM. The first principle of life.

GERMINATION. Development of an embryo.

GESTATION. Pregnancy.

GHEE. Butter clarified by boiling; used in the Hindoo sacred rites.

GIN. A spirit distilled from grain and flavored with juniper berries.

GLACIAL. Having a glassy appearance.

GLACIES. (L.) Ice.

GLADIUS. (L.) An old name for the lower part of the sternum.

GLAND. An organ of secretion.

GLANDULA. (L.) A small gland.

GLANDULAR. Resembling a gland.

GLANS. (L.) A gland.

GLASS. A hard, brittle, transparent substance, formed by fusing sand with fixed alkalies. The most important varieties are Crown, Bohemian, Flint and Bottle glass.

GLASS OF BORAX. A solid transparent mass obtained by fusing borax and then cooling it.

GLAUBER'S SALT. (Sulphate of soda.) A substance found in many mineral springs, and artificially prepared by treating common salt with sulphuric acid in the presence of sodium carbonate. It is used in medicine.

GLAUCOSIS. Opacity of the vitreous humor of the eye.

GLEET. Chronic gonorrhoea.

GLOBATE. Globe like.

GLOBULAR. Spherical or nearly so.

GLOBULE. A small particle of matter of spherical form.

GLOBULIN. (See Chemistry of the Human Body.)

GLOBUS. A ball.

GLOMERATE. Heaped; united together.

GLONIN. (See Nitro glycerine.)

GLOSSA. The tongue.

GLOSSITIS. Inflammation of the tongue.

GLOSSO-PHARYNGEAL. Relating to the tongue and the pharynx.

GLOTTIS. The narrow opening at the upper part of the larynx between the vocal chords.

GLUCOSE. (Grape sugar, starch sugar.) A sugar less soluble than cane sugar, and not equally sweet, which is found in starch, honey, and fruits. (See page 264.)

GLUCOSIDES. Substances containing glucose.

GLUCOSURIA. Diabetes.

GLUTEAL ARTERY. A branch of the hypogastric artery.

GLUTEN. (Vegetable Fibrin.) A yellow elastic insoluble substance, existing in grains and leguminous plants. It is sometimes called vegetable albumen.

GLYCERIDES. Oils having glycerine for their base.

GLYCERINE. (Glycerin.) A sweet heavy liquid consisting of carbon, hydrogen, and oxygen.

GLYCERO-PHOSPHORIC ACID. A peculiar acid obtained from brain-tissue.

GLYCERYL. A hypothetical radical entering into the composition of glycerine.

GLYCINA. (See Glycocol.)

GLYCHOCHOLIC ACID. (See Bile.)

GLYCOCOLL. (Glycina.) A complex substance resulting from the decomposition of glychocholic acid. (See Chemistry of the Human Body.)

GLYCHOL. A sweet liquid, soluble in water, and intermediate between glycerine and alcohol.

GLYCHOLIC ACID. An acid composed of oxygen and acetic acid.

GOITRE. A disease characterized by an abnormal swelling of the thyroid gland.

GONALGIA. Pain in the knee.

GONORRHOEA. An infectious discharge from the urethra.

GOSSYPIUM. Cotton.

GOULARD'S EXTRACT. (See Lead, Solution of Subacetate.)

GOUT. Inflammation of the small joints.

GRAMME. The unit of weight in the French metric system. It is about equivalent to $15\frac{1}{2}$ grains, and is the weight of a cubic centimeter of water.

GRANULAR. Consisting of grains.

GRANULATED. Granular.

GRANULATION. The forming of little fleshy bodies upon ulcers and suppurating wounds, filling up the cavities and uniting the sides.

GRANULES. Small grains; little pills.

GRANUM. (L.) Grain.

GRAPE SUGAR. (See Glucose.)

GRAPHIOIDES. (Resembling a style.) A process of the temporal bone.

GRAPHITE. A modification of carbon, having a soft consistence and metallic luster.

GRASS OIL. An essential oil obtained from scented grasses in India.

GRAVE. (From a verb meaning *to dig*.) An excavation for burial.

GRAVEL. Calculous matter formed in the kidneys.

GRAVIMETER. An instrument for measuring the specific gravity of bodies.

GRAVITY, SPECIFIC. (See Specific Gravity.)

GREEN VITROL. (See Ferri Sulphas.)

GROATS. Hulled oats.

GUANIN. A substance similar to uric oxide obtained from guano, or bird manure.

GUN COTTON. (Pyroxylin.) A very explosive substance, prepared by soaking vegetable fiber in strong nitric and sulphuric acids. See also Collodion.

GUSTATORY. Pertaining to the sense of taste.

GUTTA. (L.) A drop.

GUTTA PERCHA. The hardened

juice of a large tree growing in the vicinity of Singapore.

GUTTA SERENA. A paralysis of the optic nerve.

GUTTATED. Sprinkled with drops.

GUTTUR. (L.) The throat.

GUTTURAL. In or pertaining to the throat.

GUTTURAL ARTERY. A branch of the carotid.

GYPNUM. (See *Calcis Sulphas* and Disinfectants.)

H.

H. Symbol for hydrogen.

HABITAT. The natural locality of a plant or animal.

HABIT. } Constitutional pre-
HABITUDE. } disposition.

HÆMA. (G.) Blood. A prefix.

HÆMASTASIS. Checking the current of venous blood by dry cupping or ligatures.

HÆMATEMESIS. Vomiting of blood from the stomach.

HÆMATICA. Diseases of the sanguineous function.

HÆMATIN. } A blue-black sub-

HÆMATOSIN. } stance having a metallic luster and incapable of crystallization, obtained from the blood. Insoluble in water or alcohol but soluble in alkaline solutions.

HÆMATOLOGY. A treatise on the blood.

HÆMATOSIS. Aeration of the blood in the lungs.

HÆMOGLOBULIN. A compound known only in connection with blood corpuscles. (See page 188.)

HÆMOPTYSIS. Coughing blood from the lungs.

HÆMORRHAGE. Any morbid discharge of blood.

HÆMORRHOIDAL. Arteries and veins about the anus.

HÆMOPTOE. The spitting of blood.

HÆMORRHOIS. (G.) Hemorrhage.

HÆMORRHOIDS. Piles.

HALITUS. Vapor; the breath.

HALOGEN. A substance which, by combination with a metal, forms a haloid salt.

HALOID. Resembling salt. Applied to binary compounds, containing chlorine, iodine, and the allied elements.

HAMMA. A truss for hernia.

HAMOSUS. Hooked.

HAMULARIA. A genus of worms.

HAMULUS. A little hook.

HAPSIS. The sense of touch.

HARE-LIP. Congenital fissure of the upper lip.

HARI-KARI. The Japanese method of suicide by disemboweling with the sword,

HARMONIA. A species of synarthrosis or immovable articulation.

HAUNCH. The hip; lateral parts of the pelvis.

HAUSTUS. (L.) A draught.

HEART. A hollow, muscular organ, which is the center of the circulating system in the higher orders of animals.

HEAVY CARBONATE OF MAGNESIA. (*Magnesiæ Carbonas Ponderosa.*) A white granular powder which dissolves with effervescence in the dilute mineral acids. It is obtained by essentially the same process as that directed for carbonate of magnesia.

HEAVY OIL OF TAR. A term applied to the second set of oils which come over from the distillation of coal-tar.

HECTOGRAMME. A French measure of weight, containing a hundred grammes, or about 3,527 ounces avoirdupois.

HECTOLITRE. A French measure of capacity for liquids, containing a hundred *litres*, equal to a tenth of a cubic *metre*, nearly twenty-six and a half gallons of wine measure, or 22.0097 imperial gallons.

HELICALIS. Appertaining to the border of the ear.

HELICOID. Spirally curved like a snail's shell.

HELIX. Border of the external ear.

HELLEBORE. A medicinal plant.

HELMINTHIA. Worms in the intestinal canal.

HELMINTHIASIS. A disease in which worms are bred in the parts affected.

HELMINTHIC. Pertaining to worms.

HELODES. A fever characterized by profuse sweating

HELOPYRA. Marsh fever.

HEMACHROME. The coloring matter of blood.

HEMASTATIC. A remedy for a flow of blood.

HEMATIN, HEMATOSIN, ETC. (See *Hæmatin, Hæmatosin, etc.*)

HEMI. Prefix signifying half.

HEMIOPIA. A defect of sight by which only half an object is seen.

HEMISPHERES. The two symmetrical halves of the brain.

HEMORRHAGE. *Hæmorrhage.*

HEPAR. (L.) The liver.

HEPATIC. Pertaining to the liver.

HEPATISATION. Turning into a liver-like substance.

HEPATORRHAGIA. Bleeding from the liver.

HERBIVOROUS. Living solely upon vegetable food.

HEREDITARY. Inherited from parents or ancestors.

HERMAPHRODITE. An individual combining the characteristics of both sexes.

HERMETIC. Closed so that no air can enter.

HERNIA. An unnatural protrusion of the viscera; rupture; displacement of any part from its proper cavity.

HERNIA, CONGENITAL. Hernia existing at birth.

HERNIA, INGUINAL. Rupture at the groin.

HERNIA, SCROTAL. A hernia extending into the scrotum.

HERNIOTOMY. An operation for hernia.

HERPES. A kind of eruption on the skin.

HETEROGENEOUS. Of different substances; mixed.

HETEROLOGOUS. Of different elements combined in different proportions.

HETEROMEROUS. Unrelated as to chemical composition.

HETEROPATHY. A method of removing a morbid state by inducing another morbid state.

HEXAD. A sexvalent element; one performing the same chemical function as six atoms of hydrogen.

HEXAGONAL. Having six sides.

HEXAHEDRAL. Having six plane sides or faces.

HEXATOMIC. Composed of six atoms.

Hg. Symbol for mercury. (*Hydrargyrum*.)

HIATUS. An aperture.

HIEROGLYPHICS. Sacred picture-writing of the ancient Egyptians.

HIGH PROOF. Strongly alcoholic.

HIP. The joint of the femur and pelvis.

HIPPURIC ACID. An acid contained in urine. (See page 208.)

HIRSUTIES. Superfluous growth of hair.

HISTOLOGY. The science of the minute structure of organized bodies.

HIVES. A common name for eruption.

HOGSHEAD. A large cask; a measure of quantity, containing 63 wine gallons.

HOLDEN'S CIRCLE. (See page 66.)

HOLOCAUST. A burning entire, as at a sacrifice.

HOMOGENEOUS. Of the same nature or properties.

HOMOLOGOUS. Belonging to the same chemical series.

HONEY. Fluid prepared by the bee. (See Antiseptics.)

HORDEINE. The starch of barley.

HORRIPILATION. A creeping sensation on the skin.

HUILE. (F.) Oil.

HUILE DE CADE. (F.) Cade Oil.

HUMERUS. (L.) The bone of the upper arm.

HUMERAL. Relating to the arm.

HUMIC ACID. An acid formed from mold by boiling it with alkalis and adding acids.

HUMOR. A fluid of the body other than blood.

HUMUS. (L.) A brown substance formed by the action of the air upon solid animal or vegetable matter; a valuable constituent of soil.

HYALOID. Vitreous; transparent like glass.

HYBRID. Mongrel.

HYDRARTHROS. White swelling.

HYDATID. A serous vesicle.

HYDATIFORM. Having the appearance of a hydatid.

HYDATOID. Watery.

HYDRAGOGUE. A medicine producing a watery discharge.

HYDRAMINE. Ammonia.

HYDRAGYRI AMMONIO-CHLORIDUM. (See Ammoniated Mercury.)

HYDRARGYRI CHLORIDUM MITE. (See Calomel.)

HYDRARGYRI IODIDUM. (Iodide of Mercury.) A compound of a yellowish color, which may be prepared by rubbing mercury and iodine together in a proportion of one atom of the former to one atom of the latter, the mixture being moistened with alcohol.

HYDRARGYRUM. Mercury.

HYDRATE. A substance combined with water, generally forming a neutral salt.

HYDRATED. Combined with water.

HYDRATION. Becoming a hydrate.

HYDRIODATE. A salt formed by the union of hydriodic acid and some base.

HYDRIODIC ACID. An acid formed by the combination of hydrogen and iodine.

HYDRIOTAPHIA. Urn burial.

HYDROA. A watery pustule.

HYDROBROMATE. A salt formed by the union of hydrobromic acid and some base.

HYDROBROMIC ACID. An acid formed by the combination of hydrogen and bromine.

HYDROCARBON. A compound of hydrogen and carbon.

HYDROCARBURET. (See Hydrocarbon.)

HYDROCHLORATE. A compound formed by the union of hydrochloric acid with some base.

HYDROCHLORATE OF AMMONIA. (Sal Ammoniac.) A salt obtained from the ammoniacal liquor of gas works.

HYDROCHLORIC ACID. (Muriatic Acid, Chlorohydric Acid.) A compound of chlorine and hydrogen. It is a colorless gas, very soluble in water, fuming strongly in damp air. Symbol, HCl.

HYDROCHLORIDE. A chloride.

HYDROCYANIC ACID. (See Poisons.)

HYDROFLUORIC ACID. An acid obtained by distilling fluoride of calcium with sulphuric acid. (See Fluorine.)

HYDROGEN. A light, inflammable gas. (See page 110.)

HYDROGEN PEROXIDE. (See Antiseptics.)

HYDROGEN, PHOSPHORETTED. (See page 139.)

HYDROGENATE. To combine with hydrogen.

HYDROMETER. An instrument for determining the specific gravity of liquids.

HYDROPATHY. Water-cure.

HYDROPERICARDIUM. Dropsy in the pericardium.

HYDROPHOBIA. Convulsions and dread of water, caused by the bite of a mad dog.

HYDROPIC. Relating to dropsy.

HYDROPS. (L.) Dropsy.

HYDROPS ARTICULA. (L.) Dropsy of the joints.

HYDROSARCA. A tumor containing water and flesh.

HYDROSCOPE. An instrument intended to measure the presence of water in air.

HYDROSTATIC BALANCE. An instrument for weighing substances in water, to determine their specific gravity.

HYDROSULPHATE,) A combina-
HYDROSULPHURET. (tion of sulphuretted hydrogen with an earth, alkali, or metallic oxide.

HYDROSULPHURIC ACID. (Sulphuretted hydrogen.) A colorless gas, having the smell of rotten eggs. It is a valuable reagent in the laboratory. Formula, H_2S . (See page 221.)

HYDROTHORAX. Dropsy in the cavity of the chest.

HYDROUS. Containing water.

HYDROXIDE. A metal combined with hydroxyl.

HYDROXYL. A monad radical, containing one atom of hydrogen and one of oxygen.

HYDRURET. A compound of hydrogen with a metal.

HYGIENE. The art of preserving health.

HYGROMA. A tumor containing serous fluid.

HYGROMETER. An instrument for measuring the humidity of the atmosphere.

HYGROSCOPIC. Gathering moisture; easily affected by moisture.

HYOCHOLIC ACID. An acid found in the bile of the hog.

HYOGLOSSUS. A muscle of the tongue.

HYOIDES. A bone at the root of the tongue.

HYPER. A prefix to the names of acids, denoting an excess of oxygen.

HYPERCATHARSIS. Excessive purging.

HYPERAEMIA. Engorgement of blood-vessels.

HYPERCARBURETTED. Having the largest proportion of carbon.

HYPERCHLORIC. Containing a greater proportion of oxygen than chloric acid.

HYPERMANGANATE OF POTASSA. (See *Potassii Permanganas*.)

HYPERMANGANIC ACID. An acid having larger proportion of oxygen than manganic acid.

HYPERTROPHY. Morbid enlargement.

HYPO. A prefix denoting a compound containing a smaller quantity of oxygen.

HYPOCHLORITE OF LIME. (See *Calcis Chloridum*.)

HYPOCHONDRIUM. The region under the false ribs.

HYPODERMIC. Under the skin.

HYPOGASTRIUM. Lowest part of the abdomen.

HYPOGLOSSAL. Beneath the tongue.

HYPONITROUS ACID. (See Nitrous Acid.)

HYPOPHOSPHATE. A compound of hypophosphoric acid with a base.

HYPOPHOSPHITE. A compound of hypophosphorous acid with a base.

HYPOPHOSPHOROUS ACID. An acid obtained by decomposing hypophosphite of lime by oxalic acid.

HYPOPYON. Pus in the anterior chamber of the eye.

HYPOSTATIC. Relating to or caused by stagnation.

HYPOSULPHATE. A compound of hyposulphuric acid with a base.

HYPOSULPHURIC ACID. A heavy, colorless fluid, found only in combination with water. It contains less oxygen than sulphuric acid.

HYPOSULPHITE. A compound of hyposulphurous acid with a base.

HYPOTHESIS. A supposition.

HYPOXANTHIN. (See Chemistry of the Human Body.)

HYSTERA. The uterus.

HYSTERIA. A spasmodic affection; supposed to arise from the womb.

HYSTEROTOMY. Cæsarian Section.

I.

I. The symbol for iodine, which see.

ICE. Water crystallized by cold below 32 F. (See Antiseptics.)

ICHOR. A thin acrid discharge.

ICHTHYOSIS. Horny excrescences upon the epidermis.

ICTERUS. The jaundice.

IDIOPATHIC. A term applied to a morbid condition which arises primarily, and not in consequence of another disease or an injury.

IDIOSYNCRASY. A singularity of individual constitution.

IDIOT. One born an imbecile.

IGNITION. Taking fire.

ILEUM. The longest of the smaller intestines.

ILIAC. Pertaining to the region of the loins.

ILIUM. The superior bone of the pelvis.

IMBECILITY. Mental weakness.

IMBRICATE. Overlapping like tiles upon a roof.

IMMISCIBLE. That cannot be mixed.

IMPALPABLE POWDER. A powder whose grains are so small that they cannot be perceived by touch.

IMPERATORIA OSTRUTHIUM. (Masterwort.) A plant growing in the south of Europe, whose root is a stimulant aromatic, and once thought to be antiseptic.

IMPERFORATE. Congenitally closed up.

IMPERVIOUS. Impassable.

IMPONDERABLE. Without weight.

IMPREGNATION. Fecundation.

IMPULSION. Onward flow of fluids, as of the blood.

INANITION. Exhaustion.

INCANDESCENCE. The glowing of heated bodies.

INCARNATION. Granulation.

INCENSE. A mixture of fragrant gums, spices, etc., which produce a perfume when burned.

INCINERATE. To burn to ashes.

INCINERATION. The process of burning to ashes.

INCISION. A clean cut made with a sharp-edged instrument.

INCISORS. The front or cutting teeth.

INCOERCIBLE. In chemistry any substance that cannot be reduced to a liquid form by cold and pressure.

INCOMBUSTIBLE. That cannot be consumed by heat.

INCOMMISCIBLE. Not miscible.

INCOMPATIBLE. Not capable of union or of existing together.

INCONGRUOUS. Incompatible.

INCORPORATE. To combine into one mass or body.

INCORRODIBLE. Incapable of being corroded.

INCRASSATE. To make thicker or more dense.

INCREMENT. Increase.

INCUBATION. Hatching of eggs.

INCUBUS. Night-mare.

INCUS. One of the small bones of the internal ear.

INDELIBLE. That cannot be effaced.

INDEX. The first finger.

INDICAN. A principle existing in the indigo plant, upon which depends the formation of indigo, also found in urine in wasting disease.

INDICATOR. A muscle of the first finger.

INDIGENOUS. Produced naturally in a certain country or region; not exotic.

INDIGESTION. Dyspepsia.

INDISSOLUBLE. That cannot be dissolved.

INDIUM. A soft white metal resembling cadmium, discovered in 1863 in certain zinc ores.

INDURATION. Hardening.

INERT. Inactive; unable to produce effect.

INEXHALABLE. Incapable of evaporation.

INFECTION. The transmission of disease from one person to another by direct contact.

INFILTRATE. To enter into the pores or interstices.

INFINITESIMAL. Inconceivably small.

INFLAMMABLE. Capable of combustion.

INFLAMMATION. Redness, heat, tension and swelling, due to the congestion of a part.

INFUSION. A medicine prepared by steeping a substance in hot or cold water.

INFUSORIA. (L.) Microscopic animals found in fluids.

INGREDIENT. One of the constituent parts of a compound.

INGUEN. The groin.

INGUINAL. Pertaining to the groin.

INHALATION. Drawing in the breath.

INHUMATION. Burial in the earth.

INJECTION. A liquid administered with a syringe.

INNATE. Existing at the time of birth.

INNOCUOUS. Harmless.

INNOMINATA ARTERIA. The right branch of the aorta.

INNOMINATUM OS. The bone formed by the union of the ilium, ischium, and pubic bones of the pelvis.

INOCULATION. Insertion of poison into the body.

INODOROUS. Scentless.

INORGANIC. A term applied to bodies which have no organs, such as minerals.

INOSCUATION. Union of the extremities of vessels, as of the arteries and veins by means of the capillaries.

INOSITE. Sugar of muscular flesh. (See page 174.)

INSALIVATION. Mixture of food with saliva in mastication.

INSANITY. Mental derangement.

INSERTION. Attachment of a muscle or tendon to the part which it moves.

INSIPID. Tasteless.

INSOLATE. To expose to the heat of the sun.

INSOLUBLE. That cannot be dissolved.

INSOMNIA. Sleeplessness.

INSPIRATION. Act of taking air into the lungs.

INSPISSATION. Thickening, or boiling down.

INSTRUMENTAL LABOR. Child birth requiring the use of forceps or other instruments.

INTER. A prefix denoting *between*.

INTERARTICULAR. Between the joints.

INTERCOSTAL. Between the ribs.

INTERMISSION. Time intervening between the recurrences of a periodic disease.

INTERMITTENT. Ceasing at intervals.

INTERMIX. To mix together.

INTERNAL. Pertaining to the inside.

INTERNE. (F.) A house physician.

INTEROSSEOUS. Between the bones.

INTERSPACES. Intercostal spaces.

INTERSTITIAL. Occurring in the interstices of an organ.

INTERVAL. Intermission.

INTERVERTEBRAL. Occurring between the vertebræ.

INTESTINES. The bowels.

INTRORSE. Turned inwards.

INTUMESCENCE. A swelling.

INTUMESCENT. Swelling.

INULIN. A variety of starch obtained from the roots of certain vegetables.

INVERSION. A turning inside out.

INVERTEBRATA. Animals without an internal bony structure.

IODATE. A combination of iodic acid with some base.

IODIC ACID. An acid chemically corresponding to chloric acid. Formula, HIO_3 .

IODIDE. A binary compound of iodine with a metal or other substance.

IODINE. One of the chemical elements. (See page 110.)

IODINUM. (L.) Iodine.

IODOFORM. (Teriodide of Formyl.) An insoluble yellow solid, of sweet taste and peculiar odor, produced by the action of iodine on a great number of organic substance. (See Antiseptics.)

IODOL. See Antiseptics.

IODOSIS. Morbid effects of iodine.

IRIDECTOMIA. Operation by excision for artificial pupil.

IRIDITOMIA. Operation by incision for artificial pupil.

IRIDIUM. A very hard, rare metal discovered in 1803. Specific gravity about 22.

IRIS. (L.) A delicate circular membrane of the eye, suspended vertically behind the cornea, its perforation forming the pupil.

IRITIS. Inflammation of the iris.

IRON. One of the metallic elements. (See page 110.)

IRREDUCIBLE. A term applied to incurable dislocations and fractures.

IRRIGATION. Keeping a part wet.

IRRITATION. Excessive action of any stimulus, causing a morbid increase in the circulation or sensibility.

ISCHIAS. Rheumatism of the hip joint.

ISCHIUM. Lower bone of the pelvis.

ISCHURIA. Retention of the urine.

ISINGLASS. Fish glue, obtained originally from the bladder of the sturgeon.

Iso. A prefix meaning equal.

ISOCHRONOUS. Occurring at equal periods of time.

ISOLABLE. Capable of being obtained in a pure state free from foreign substances.

ISOLOGOUS. Having similar proportions or relations.

ISOMERIC. Of similar atomic proportions.

ISOMERISM. An identity of ele-

ments and of atomic proportions, with a difference in the amount combined in the compound molecule and of its essential qualities.

ISOMORPHISM. A similarity of form.

ISOMORPHOUS. Similar in form.

ISOPATHY. Treating a disease by a medicine which produces the same effect as the disease.

ISOTHERMAL. Possessing the same temperature.

ITCH. An eruption on the skin.

ITER. (L.) A passage between parts.

IVORY BLACK. Animal charcoal.

J.

JACTATION. Tossing about.

JAMESTOWN WEED. A name for *Datura Stramonium*. (See Poisons.)

JANIPHA MANIHOT. Cassava plant.

JANITOR. A name applied to the pyloric orifice of the stomach.

JAPAN. A varnish used in lacquering metallic and other surfaces.

JAPAN CAMPHOR. A variety of crude camphor.

JAUNDICE. A disease characterized by yellowness of the skin and eyes, dependent upon obstruction of the biliary excretion.

JAVELLE'S WATER. (See Hypochlorite of Potassa Solution, and Antiseptics.)

JECUR. (L.) The liver.

JEJUNUM. The second of the smaller intestines.

JELLY. A stiffened solution of gum and the like, translucent, and intermediate in condition between solid and fluid.

JERKED BEEF. Beef preserved by being exposed to the sun in a dry atmosphere.

JEWS' FRANKINCENSE. Gum styrax or benzoin.

JEWS' TURPENTINE. Asphaltum.

JOINT. An articulation.

JUGAL PROCESS. The zygomatic process of the temporal bone.

JUGAL SUTURE. The suture uniting the malar bone with the upper jaw.

JUGULAR. Pertaining to the throat.

JUGULAR VEINS. The main internal and external veins of the neck.

JUGULUM. (L.) The throat.

JUNIPER. An erect evergreen shrub, from eight to sixteen feet high, a native of Europe, and cultivated in this country. Its tops and berries are stimulant and antiseptic.

JUNIPER CAMPHOR. A camphor formed by the action of hydrochloric acid on oil of juniper.

JURISPRUDENCE, MEDICAL. Legal medicine.

JUVANS. (L.) An auxiliary remedy.

JUVENTUS. (L.) Adolescence.

K.

K. Symbol for potassium. (Kalium.)

KÆSTVAEN. The Saxon name given the early English burial mounds.

KALI. Potash.

KALIUM. Potassium.

KAOLIN. A variety of clay used for making porcelain; it arises from the decomposition of feldspar.

KERATIN. The organic basis of horny tissues, hair, nails, feathers, etc.

KEROSENE. A hydrocarbon oil extracted from bituminous matter.

KIDNEYS. Glandular bodies in the lumbar region secreting urine.

KILOGRAM. } French meas-
KILOGRAMME. } ure of weight
being one thousand grammes, or about two pounds.

KILOLITER. } A French meas-
KILOLITRE. } ure of quantity,
being one thousand litres.

KINATE. A salt formed by the union of kinic acid with a base.

KING'S EVIL. An old name for scrofula, which it was supposed could be cured by a royal touch.

KINOL. A volatile principle obtained from coal-tar, identical with anilin.

KORETOMIA. Operation for artificial pupil.

KREATIN. (See Creatin.)

L.

L. Symbol for lithium.

LABARIUM. Looseness of teeth.

LABARRAQUE'S SOLUTION. A disinfecting fluid, the basis of which is chlorinated soda. (See Chloride of Soda Solution.)

LABIA. (L.) The lips.

LABIAL. Pertaining to the lips.

LABELLUM. A little lip.

LABIATE. Having lips.

LABIUM. (L.) Singular of labium.

LABOR. Parturition.

LABORATORY. Place for chemical operations.

LABYRINTH. Second cavity of the ear.

LAC. (L.) Milk.

LAC. A resinous substance obtained from certain trees; it is the chief ingredient of sealing-wax.

LACERATION. Tearing.

LACHRYMA. (L.) Tear.

LACHRYMAL. Concerned in the secretion and transmission of the tears.

LACHRYMATORIES. Tear jugs found in ancient tombs.

LACTATE. A salt formed by the union of lactic acid with a base.

LACTATE OF ZINC. A compound obtained by treating lactate of potassa with acetate of zinc.

LACTATION. The suckling of young.

LACTEALS. Absorbent vessels of the lymphatic system.

LACTESCENT. Milk-like.

LACTIC ACID. A colorless syrupy liquid obtained from sour milk. (See Chemistry of the Human Body, page 259.)

LACTIFEROUS. Carrying milk.

LACTOMETER. An instrument for measuring or ascertaining the quality of milk.

LACUNA. (*Plural, lacunæ, L.*) A term applied to the excretory ducts of mucous glands.

LAMINA. (L.) A layer or plate.

LAMINATED. Foliated in structure, as the bones.

LAMP-BLACK. Fine soot formed by the condensation of the smoke of burning resinous matter.

LANA PHILOSOPHICA. (L.) Philosopher's wool. A name formerly given to oxide of zinc prepared by combustion.

LANATUS. (L.) Woolly.

LANCET. A cutting instrument used in venesection.

LANTHANUM. A rare metal; symbol, La.

LANGUOR. Debility.

LAPIS INFERNALIS. (L.) Caustic potash.

LARD. Animal fat freed from saline matter.

LARDACEOUS. Resembling lard.

LARYNGEAL. Belonging to the larynx.

LARYNGITIS. Inflammation of the larynx.

LARYNGOPHONY. Sound of the voice in the throat.

LARYNGOTOMY. Incision into the larynx.

LARYNX. The top of the wind-pipe, including the organs of voice.

LATA. (L.) Broad.

LATA LIGAMENTA. (L.) Broad ligaments.

LATENT. Hidden.

LATERAL. Belonging to the side.

LATERITIOUS. A term applied to a brick-dust sediment in the urine.

LATISSIMUS DORSI. (L.) A broad and thin muscle of the back.

LATUS. (L.) Broad.

LAUDABLE PUS. Healthy pus discharged from wounds or ulcers in the healing state.

LAUDANUM. The tincture of opium. (See Poisons.)

LAUGHING GAS. (See Nitrous oxide.)

LAURUS CASSIA. The source of cassia.

LAURUS CINNAMOMUM. (See Cinnamon.)

LAVEMENT. (F.) A fomentation; a clyster.

LAVIPEDIUM. (L.) A foot-bath.

LAX. Diarrhœa.

LAXATIVE. A gentle purgative.

LAZARETTO. A lazaret-house for disinfecting person and goods from contagious diseases.

LEAD. (*Plumbum*.) A common, soft, heavy metal. (See page 110.)

LEAD, NITRATE. (See Antiseptics.)

LEAD, SOLUTION OF SUBACETATE. (Goulard's Extract.) A preparation obtained by boiling together acetate of lead and oxide of lead, and filtering the solution. It is used externally. See Poisons.

LEAD, SUGAR OF. (See Acetate of Lead.)

LEAD, WATER. (See Lead, Solution of Subacetate.)

LECITHIN. See page 182.

LEDOYEN'S DISINFECTING FLUID. A preparation formed by dissolving a drachm of lead in an ounce of water. (See Antiseptics.)

LENITIVE. A term applied to gentle remedies.

LENS. The crystalline body of the eye, transparent in health, opaque in cataract.

LENTICULAR. Shaped like a lens; a variety of cataract.

LENTICULAR BONE. Os orbiculare of the ear.

LEPIDOSIS. Scale; skin.

LEPIDOTE. Scaly.

LEPRA. Leprosy.

LEPROSY. An endemic disease prevailing in the East.

LEPROUS. Afflicted with leprosy.

LEPTOTHRIX. A colony of bacteria clustered together end to end.

LEPTOTHRIX BUCCALIS. A species of the above found in the mouth.

LESION. A hurt or injury.

LETHAL. Pertaining to death.

LETHARGY. Deep sleep or stupor.

LEUCIN. (See page 157.)

LEUCOMA. A white speck on the eye.

LEUCOSIS. Disease of the lymphatics.

LEVATOR. (D.) That which lifts up; name of certain muscles.

LEVIGATION. (Porphyriation.) Reduction to an impalpable powder.

LEVULOSE. (See Glucose.)

LIBATIONS. Liquids poured forth in sacrifice, in honor of some deity.

LIBRA. (L.) A pound of twelve ounces.

LIGAMENT. An elastic, tendinous cord.

LIGATION. Securing an artery by ligature.

LIGATURE. A thread by which an artery or vein is tied. (For choice see page 291.)

LIGHT OIL OF TAR. A name given to the condensation of the more volatile principles, which first come over in the distillation of coal tar.

LIGHT OIL OF WINE. An oil obtained from distilling alcohol with an excess of sulphuric acid.

LIGNEOUS. Of the nature of wood.

LIGNINE. One of the constituents of woody fibre.

LIGULA. (L.) A strap.

LIMATURA FERRI. (L.) Iron filings.

LIME. (See *Calx* and Antiseptics.)

LIME, SOLUTION OF CHLORINATED. (See *Liquor Calcis Chloratæ*.)

LIMOSIS. (L.) Morbid hunger.

LIMPID. Clear, transparent.

LINEA. (L.) A line.

LINGUAL. Pertaining to the tongue.

LINIMENT. A fluid ointment for rubbing.

LINSEED. Flaxseed.

LIPARIA. Excess of fat.

LIPOMA. An adipose encysted tumor.

LIQUEFACTION. Turning from a solid into a liquid state.

LIQUID. A substance whose parts change their relative position on the slightest pressure. The term *fluid* extends to air and gases, but *liquid* does not embrace aeriform substances.

LIQUOR. A term applied to an aqueous solution in which the subject acted on is wholly dissolved in water.

LIQUOR AMNII. (L.) Water surrounding the fetus in the uterus.

LIQUOR PLUMBI, SUBACETATIS. (L.) (See Lead, Solution of Subacetate, and Antiseptics.)

LIQUOR POTASSÆ PERMANGANATIS. (L.) Solution of permanganate of potash; a disinfectant.

LIQUOR SODÆ CHLORATÆ. (L.) (See Chloride of Soda Solution.)

LIQUOR ZINCI CHLORIDI. (L.) (See Antiseptics.)

LISTER DRESSING. A surgical dressing designed to exclude bacteria and germs by means of antiseptic gauze, waterproofing and bandages.

LITER. (*Litre*.) A cubic decimetre, equal to about 1.76 pints.

LITHARGE. Yellow monoxide of lead.

LITHATE. A compound of lithic acid with some base. (See Urates.)

LITHIA. The oxide of lithium, occurring in various minerals and mineral waters.

LITHIC. Relating to uric acid.

LITHIUM. The lightest of the metals. It is of a white color, and fuses at 180°.

LITHONTRIPSY. Crushing stone in the bladder.

LITHOTOMY. Cutting for stone in the bladder.

LITHURIA. Urine containing uric acid or urates.

LITMUS. A blue substance used by chemists for detecting free acids.

LITRE. (See Liter.)

LIVER. The organ of the body which secretes the bile.

LIVID. Having a purplish discoloration.

LIXIVIATE. } Impregnated with
LIXIVIATED. } salts from wood ashes.

LIXIVIATION. The extraction of alkaline salts from ashes by pouring water on them.

LOBE. A division of an organ.

LOBE OF THE EAR. The lower extremity of the outer ear.

LOBULUS. (L.) A small lobe.

LOCAL. Confined to a part.

LOCHIA. The discharge from the womb after parturition.

LOIMIC. Pertaining to pestilence.

LOINS. The lumbar region.

LONGISSIMUS. (L.) The longest.

LONGITUDINAL. Belonging to length; lengthwise.

LONGUS. (L.) Long; the name of certain muscles.

LORDOSIS. Curvature of the spine forwards.

LOTIO. (L.) A lotion.

LOTION. A fluid medicine to be applied externally by rubbing.

LUBRICATE. To oil or make smooth.

LUCID. Clear.

LUES. (L.) A poison or pestilence.

LUMBAGO. A rheumatic affection of the loins.

LUMBAR. Pertaining to the loins.

LUMEN. A light. This term is sometimes used to denote the caliber of a tube or vessel through which the light may be seen.

LUNAR CAUSTIC. A name for nitrate of silver, which substance was used as early as the days of the

ancient Egyptians, who marked their mummy bandages with silver nitrate so that the writing might be indelible.

LUNATE. Shaped like a new moon.

LUNGS. The organs of respiration occupying the chest.

LUSTRAL. Pertaining to purification.

LUSTRATION. A sacrifice or ceremony by which cities, fields, armies or people, defiled by crimes, were supposed to be purified.

LUTE. A compound paste or cement for closing retorts, etc., in chemical operations.

LUTED. Closed with lute.

LUTEIN. A name given to the crystallizable yellow principle found in the yolk of eggs, in carrots, etc.

LUXATION. Dislocation.

LYE. Water impregnated with alkaline salts imbibed from the ashes of wood.

LYMPH. A thin animal fluid found in the lymphatics.

LYMPHADENOMA. A disease characterized by great enlargement of the lymphatic glands, and a morbid deposit in the spleen.

LYMPHATICS. The vessels which carry the "white blood" through the system.

M.

M. Mix or incorporate.

MACE. (Macis). The yellowish, aromatic coating of the nutmeg.

MACERATE. To soften by thoroughly steeping.

MACERATION. The process of softening by steeping.

MACIS. (See Mace.)

MACULA. (L.) A spot or blemish.

MADDER. The root of *rubia tinctorum*, which is used for coloring purposes.

MADEIRA WINE. The strongest of white wines, possessing a rich, aromatic flavor.

MAGISTER. A title of the middle

ages, equivalent to the modern title of doctor.

MAGISTERY. A precipitate.

MAGISTRAL FORMULÆ. Compound medicines, extemporaneously prepared.

MAGNESIA. The oxide of magnesium; one of the alkaline earths.

MAGNESIA, CALCINED. Magnesia exposed to a red heat for some time.

MAGNESIA, ALBA. See Carbonate of Magnesia.)

MAGNESIA, SULPHATE. (See Epsom Salts.)

MAGNESITE. The silicate of magnesia.

MAGNESIUM. A metal of a silver white color, which fuses at a low, red heat. When strongly heated in the air, it takes fire and burns with a dazzling white light, forming its only oxide, magnesia.

MAGNETIC OXIDE OF IRON. A native oxide, occurring in octahedral crystals. As the mineral lodestone, it forms one of the most valuable ores of iron.

MAGNETIC PYRITES. A sulphuret which may be artificially prepared by applying solid sulphur to white-hot iron.

MAHOGANY. (*Swietenia Mahoganii*.) A tree growing in Southern Florida, Central America, and the West Indies, whose wood is much used for ornamental work.

MAIZE. Indian corn.

MAJOR. (L.) Greater.

MALACHITE. Native carbonate of copper, having a beautiful green color.

MALACOSTEON. (G.) Softness of the bones.

MALAGA. A kind of wine imported from the Spanish city of the same name.

MALARIA. A poison generated in unhealthy soils; miasma.

MALAR. Belonging to the cheek.

MALATE. A salt formed by the union of malic acid with some base.

MALATE OF IRON. A salt formed by the union of malic acid with iron.

MALFORMATION. Defective structure.

MALIC ACID. An acid obtained from apple juice; it crystallizes in brilliant, prismatic needles, and is very soluble.

MALIGNANT. Dangerous or pestilential.

MALINGERING. Feigning sickness.

MALLEABILITY. Property of being extended when beaten, possessed by certain metals.

MALLEOLAR. Pertaining to the ankle.

MALLEOLUS. The ankle.

MALLEUS. (L.) A hammer; the small bone of the inner ear, resembling a hammer.

MALPIGHIAN BODIES. Small bodies constituting part of the kidneys.

MALT. Barley grains made to germinate by warmth and moisture, and then baked so as to deprive them of vitality.

MALTHA. (Mineral Tar.) A name given to semifluid asphaltum or petroleum.

MALTOSE. A sugar resembling glucose in many of its properties, and existing in malt, being the first product of the action of diastase upon starch.

MALUM. (L.) A disease.

MAMMA. (L.) The female breast.

MAMMALIA. Animals which suckle their young.

MAMMARY. Belonging to the breasts.

MAMMIFORM. Nipple-shaped.

MANDIBULA. The jaw.

MANES. Souls of the departed.

MANGANESE. A reddish-white, hard, brittle metal, which decomposes water at the ordinary temperature and cannot be preserved in air without undergoing oxidation.

MANGANESE DIOXIDE. (See Black Oxide of Manganese.)

MANGANESE, PHOSPHATE. A salt prepared from sulphate of manganese and phosphate of soda.

MANGANESE, SULPHATE. A salt obtained by treating black oxide of manganese with sulphuric acid.

MANGANESE, TARTRATE. A salt formed by the union of tartaric acid with manganese.

MANGANESEIUM. (See Manganese.)

MANIA. Insanity; delirium.

MANIPULATION. Using the hands in a skilful manner.

MANOMETER. An instrument for measuring the pressure exercised by gases or liquids.

MANUS. (L.) The hand.

MARASMUS. Atrophy; emaciation.

MARC. (F.) The refuse matter remaining after the pressure of fruits, especially grapes.

MARGARATE. A compound of margaric acid with some base.

MARGARIC ACID. An acid obtained by digesting soap in water with an acid.

MARINE ACID. (See Hydrochloric Acid.)

MARS. An ancient designation for the metal iron.

MARSEILLES VINEGAR. (Thieves' Vinegar.) A vinegar impregnated with aromatic substances. It received its name from the circumstance that four thieves, who, during the plague at Marseilles, had plundered dead bodies with impunity, owed their safety to its use.

MARTIAL. Relating to iron.

MARTIAL ETHIOPS. (See Magnetic Oxide of Iron.)

MASSETER. The muscle of the lower jaw.

MASSICOT. The yellow oxide of lead, called also *litharge*. Symbol, PbO.

MASTICATION. Chewing.

MASTOID. Nipple-shaped.

MATERIA. (L.) Matter.

MATERIA MEDICA. (L.) The science of medicines.

MATERIES MORBI. (L.) Morbid matter; the matter or material which is the cause of disease.

MATRASS. An egg-shaped chemical

flask, with a tapering neck, open at the top.

MATRIX. (L.) The womb.

MATURATION. Ripening.

MAUSOLEUM. (See Mausolus.)

MAUSOLUS. A king of Caria, the husband of Artemisia, who erected to his memory a magnificent monument, the *Mausoleum*, which was reckoned one of the seven wonders of the world.

MAXILLA. The jaw.

MAXILLARY. Pertaining to the jaw.

MAXIMUM. (L.) The greatest; the highest dose.

MEASLES. An epidemic eruptive fever.

MEATUS. (L.) A passage.

MEATUS AUDITORIUS EXTERNUS. The auditory canal.

MEATUS AUDITORIUS INTERNUS. Inner auditory passage.

MEATUS URINARIUS. The orifice of the urethra.

MECHANICAL. Agents which are non-chemical.

MEDIAN. That which is situate in the middle.

MEDIAN LINE. An imaginary line drawn vertically through the symmetrical center of the body.

MEDIASTINUM. The membranous septum between the lungs, dividing the thorax behind the sternum.

MEDIATE AUSCULTATION. Using the stethoscope in listening to the sounds of internal organs.

MEDICAL. Relating to medicine.

MEDICAMENT. A remedy.

MEDICASTER. A quack.

MEDICINAL. Possessing curative powers.

MEDICINE. A substance administered in the treatment of disease.

MEDICO-LEGAL. Pertaining to law as affected by medical facts.

MEDICUS. (L.) A physician.

MEDULLA. Marrow; pith.

MEDULLA OBLONGATA. (L.) Upper part of a spinal chord where it joins the base of the brain.

MEDULLARY. Resembling or belonging to marrow.

MEL. (L.) (See Honey and Antiseptics.)

MELAENA. Black discharges from the bowels.

MELANCHOLY. A disease characterized by gloominess and general depression of mind.

MELANIN. The black pigment of the choroid, melanotic tumors and skin of the negro; it occurs pathologically in the urine, and is deposited in the air-passages.

MELANOSIS. A black morbid deposit.

MELISSA. (See Balm.)

MEMBRANE. A skin-like tissue composed of interwoven fibers, covering some part of the body.

MEMBRANES, MUCOUS. Those investing or lining cavities or canals which communicate with the open air.

MEMBRANES, SEROUS. Those lining cavities which have no external communication. They have a smooth, glossy surface, from which exudes a transparent serous fluid which gives them their name.

MEMBRANOUS. Having the texture of membrane.

MEMBRUM. (L.) A member; a limb.

MENINGITIS. Inflammation of the membranes of the brain.

MENSES. Monthly flow from the uterus.

MENSTRUUM. A solvent, or vehicle.

MENSURATION. The act or process of measuring the thorax, abdomen, etc.

MENTHA. A family of fragrant herbs, including peppermint, spearmint and pennyroyal. (See Antiseptics.)

MEPHITIC. Offensive to the smell; foul; poisonous; noxious.

MERCURIAL. Relating to, or containing mercury.

MERCURY. The metal quicksilver. (See page 111.)

MEROS. (G.) The thigh.

MERUS. (L.) Pure; unadulterated.

MESENTERIC. Pertaining to the mesentery.

MESENTERY. The largest process of the peritoneum, to which the jejunum and ileum intestines are attached.

MESIAL LINE. The middle line.

MESITYLENE. A colorless liquid derived from acetone, having an odor not unlike that of oil of peppermint.

MESOCOLON. Membrane of the colon.

METABOLITES. That thrown out, or excreted, from the body.

METACARPAL. Belonging to the metacarpus.

METACARPUS. The hand between the wrist and the fingers.

METACHLORAL. A white volatile solid, having an ethereal odor; insoluble in water, alcohol and ether; convertible at 180° into the liquid chloral.

METAL. An electro-positive substance having a peculiar luster, insoluble in water, a good conductor of heat and electricity, and generally solid at ordinary temperatures.

METALDEHYDE. A substance crystallized in long prisms, resulting from the decomposition of aldehyde.

METALLIC PHOSPHORUS. A crystalline modification of phosphorus, obtained by heating together red phosphorus and lead in a close vessel.

METALLOID. An inflammable non-metallic body, such as sulphur, phosphorus, etc.

METAMERIC. Having the same chemical composition, but differing in physical properties.

METAMORPHOSIS. Transformation.

METAPHOSPHATE. A salt formed by the union of metaphosphoric acid with some base.

METAPHOSPHORIC ACID. A trans-

parent, ice-like mass obtained by evaporating a solution of trihydrogen phosphate and igniting the residue. Formula, HPO_3 .

METASTANNIC ACID. An acid in the form of a white powder, obtained by the action of nitric acid on pure tin.

METASTASIS. The shifting of a disease from one part of the body to another.

METASTATIC. Belonging to metastasis.

METATARSUS. The foot between the ankle and toes.

METHOL. A colorless liquid obtained in the distillation of wood.

METHYL. A compound radical with the formula CH_3 .

METHYLAMIN. A colorless condensible gas with a strong ammoniacal smell and powerful alkaline reaction.

METHYLATED SPIRIT. Alcohol mixed with one-ninth of its bulk of pyroxylic spirit.

METHYLIC ALCOHOL. A spirit obtained in the destructive distillation of wood.

METHYL-SALICYLIC ACID. (Salicylate of Methyl.) An acid constituting nine-tenths of the oil of gaultheria, and which forms, with bases, crystalline salts.

METOPUM. The forehead.

METRIC. Pertaining to measurement.

METRIC SYSTEM. See tables at the end of lexicon.

METRITIS. Inflammation of the womb.

MG. Symbol for magnesium.

MIASM. Morbid emanation.

MICA. A mineral occurring in thin plates.

MICROBACTERIA. Smallest bacteria.

MICROBES. Minute forms of life. (See Bacteria.)

MICROCOCCUS. The best known form of the sphero-bacteria.

MICROCOSM. A little world.

MICROMETER. An instrument for measuring very small intervals.

MICROSUBLIMATION. A process of recognizing volatilized substances, consisting in the joint application of a subliming heat and of the microscope.

MICTURITION. Urination.

MIDRIFF. The diaphragm.

MILD CHLORIDE OF MERCURY. (See Calomel.)

MILK LEG. An inflammation of the inguinal glands and the lymphatics of the leg; usually occurring after child-birth.

MILK OF LIME. Lime in excess mixed with water so as to form a thick liquid.

MILK SICKNESS (Trembles.) A peculiar endemic disease.

MILK TEETH. The first set of teeth.

MILLIGRAM. } A French mea-

MILLIGRAMME. } sure of weight, being the thousandth part of a gramme (.015 grains).

MILLILITER. } A French measure

MILLILITRE. } of capacity, being the thousandth part of a litre.

MILLIMETER. } A French measure

MILLIMETRE. } of length, being the thousandth part of a metre.

MIMI. Imitative actors who appeared in the Roman funeral procession.

MIMOSA-RESIN. Myrrh.

MINERAL. Any inorganic substance having a definite chemical composition.

MINERAL ALKALI. Native carbonate of soda.

MINIM. The sixtieth part of a fluid drachm.

MISANTHROPY. Morbid love of solitude.

MISCARRIAGE. Expulsion of the fetus in the earlier months of pregnancy.

MISCIBLE. Capable of being mixed.

MISTURA. (L.) A mixture.

MITRAL. Name of the left auriculo-ventricular valves of the heart.

MOBILITY. Excessive nervous susceptibility.

MODUS OPERANDI. (L.) The manner of action.

MOIST PEROXIDE OF IRON. A precipitate obtained by adding to a solution of tersulphate of iron, water of ammonia to excess.

MOLARS. The large grinding-teeth in the back part of the jaw.

MOLASSES. Impure syrup obtained in the making of sugar.

MOLECULAR ATTRACTION. Attraction acting between the molecules of bodies at insensible distances.

MOLECULE. (See page 118.)

MOLLITIES. (L.) Softening.

MOLYBDATE. A compound of molybdic acid with some base.

MOLYBDENUM. A rare metal.

MONAD. A minute infusorial organism; also a term used in chemistry. (See page 120.)

MONAD, MICROCOCCUS, OR MONER. Immobile point-like microbes, often regarded as spores.

MONAS CREPUSCULUM. The most frequent form of infusorial life.

MONOAMMONIAC CARBONATE. (Bicarbonate of Ammonia.) A salt of ammonia, formed from the sesquicarbonate.

MONOBASIC. Having only one part of base to one of acid.

MONOGRAPH. A treatise on some special topic.

MONOHYDRATED NITRIC ACID. The strongest nitric acid that can be procured.

MONOMANIA. Insanity upon some single subject.

MONS VENERIS. (L.) The public prominence in women.

MONSTER. An unnatural formation.

MORBID. Diseased.

MORBIFIC. Causing disease.

MORBUS. (L.) A disease.

MORDANT. A substance used to fix the colors in dyeing.

MORGUE. (F.) A building in which the bodies of the unknown

dead are exposed for identification.

MORIBUND. Dying.

MORPHIA. The chief narcotic principle of opium, from which it is extracted by water and purified.

MORPHOLOGY. The science which treats of ideal forms of structure.

MORS. (L.) Death.

MORTIFICATION. Death of a part.

MORTUARY. Pertaining to the burial of the dead; also a place for their deposition.

MOSCHUS. (Musk.) A fragrant substance secreted by the musk-deer.

MOTHER-LIQUOR. } The impure

MOTHER-WATER. } residue of a solution from which crystals have been obtained.

MOTHER OF VINEGAR. (Mycoderma Aceti.) A vegetable growth necessary for the acetification of alcohol.

MOTOR. That which moves; nerves upon which voluntary action depends.

MOTORY. Giving motion.

MUCATE. A salt formed by the union of mucic acid with some base.

MUCEDO. The germ of the microscopic plants upon which fermentation depends.

MUCIC ACID. An acid obtained from gums by the action of nitric acid.

MUCILAGE. A solution of gum.

MUCIN. A compound contained in the secretions of mucous membranes. (See page 160.)

MUCORS. Bacteria.

MUCUS. A viscid fluid secreted by the mucous membrane. (See page 159.)

MUCOUS. Slimy.

MUCOUS MEMBRANE. (See Membrane, Mucous.)

MULTIFIDOUS. Divided into many parts.

MULTILOCLAR. Having many cells.

MULTIRAMOSE. Having many branches.

MUMMY. A body preserved in a dry state. The Arabic word *moumya* probably comes from two Coptic words, signifying *dead*, and *salt*. In Arabic *mum* signifies wax. The Egyptian mummies still extant are dry, black and brittle, although some of a yellowish color are flexible to the present day. This is probably due to their having been injected with some chemical fluid in the veins. The mummies of cats, crocodiles, bulls and other animals are also of frequent occurrence.

MURAL. Pertaining to a wall.

MUREXIDE. A purple dye-stuff, obtained by the reaction of nitric acid on the uric acid.

MURIATE. A salt obtained by the union of muriatic acid with some base.

MURIATE OF AMMONIA. (See Ammonia Hydrochlorate.)

MURIATE OF SODA. (See Chloride of Sodium.)

MURIATIC. Pertaining to, or obtained from sea-salt, as

MURIATIC ACID. (See Hydrochloric Acid.)

MURIATIC ACID GAS. The vapor of hydrochloric acid. It is colorless, possesses a pungent odor, and has the property of destroying life and extinguishing flame.

MURIDE. An old name given to bromine on account of its being obtained from sea-water.

MUSCLE. An organ of motion in animals, consisting of fibers inclosed in cellular membrane.

MUSCULAR. Pertaining to muscle.

MUSK. (See Moschus.)

MUST. The expressed juice of the grape.

MUTILATION. Want of a member.

MYCELIUM. A filamentous body from which a mushroom or fungus is developed.

MYCETES. A family of plants to which the genera *Spermaedia* and *Boletus* belong.

MYCODERMA. (See Mother of Vinegar.) Colonies of bacteria in sheets, and immobile.

MYLO-HYOIDEUS. Name of muscles of the lower jaw.

MYLOIDES. Like a muscle.

MYOLOGY. Description of the muscles.

MYOPIA. Short-sightedness.

MYOPS. One who is short-sighted.

MYOSIN. (See page 172.)

MYOSIS. Unnatural contraction of the pupil.

MYOSITIS. Inflammation of muscles.

MYOTOMY. Cutting of a muscle.

MYRIAGRAM. } A French

MYRIAGRAMME. { measure of weight, being ten thousand grammes.

MYRIALITER. } A French meas-

MYRIALITRE. { ure of capacity, being ten thousand litres. (See Metric Tables.)

MYRISTICA. (Nutmeg.) The tree yielding nutmeg and mace.

MYRRH. (*Myrrha*.) A gum resin obtained from the *Balsamodendron myrrha*. It was used by the Egyptian embalmers to fill the cavity of the abdomen with. (See Antiseptics.)

N.

N. Symbol for nitrogen.

NA. Symbol for sodium.

NACTA. An abscess of the breast.

NEVUS. A birth-mark; a blemish.

NAILS. Horny laminæ on the extremities of the fingers and toes.

NAPHTHA. (Commercial Benzine.) A volatile hydrocarbon condensed in the distillation of purified petroleum.

NAPHTHALIN. A white, shining, crystalline substance obtained by distilling coal tar.

NARCOSIS. The effect produced by narcotic drugs.

NARCOTIC. Stupefying; producing sleep.

NARD. (Spikenard.) The aromatic root of a species of valerian. The ancients were acquainted with several kinds; lavender was known as pseudo-nard and largely used in public and private baths, but true oil of nard was very expensive, and possessed a delightful fragrance, and was only employed in pomades, etc.

NARES. (L.) The nostrils.

NASAL. Pertaining to the nose.

NASCENT. In the act of being produced or developed.

NASUS. (L.) The nose.

NATANS. (L.) Floating.

NATRON. The native neutral carbonate of soda, found in the "natron lakes" of the Libyan desert. In the process of embalming, the ancient Egyptians used this substance as a bath, in which the body was kept immersed for seventy days; it was also placed in the abdomen, together with cedar chips. (See Antiseptics.)

NATRUM. The old name for sodium.

NAVEL. The depression in the center of the abdomen.

NEBULA. (L.) A cloud or speck in the cornea of the eye; sometimes used as a synonym for "vapor."

NECROLOGY. Mortality.

NECROPSY. } Post-mortem

NECROSCOPY. { examination.

NECROSIS. Death of a bone.

NECTAR. The honey and other sweetish secretions of the glands of plants.

NEOPLASTY. A surgical operation for the formation of new parts.

NEPHRALGIA. Pain in the kidney.

NEPHRITIC. Pertaining to the kidney.

NEPHRITIS. Inflammation of the kidney.

NEPHROS. (G.) The kidney.

NEPHROTOMY. Cutting a stone out of the kidney.

NEROLI. An oil obtained from orange flowers, and much used in perfumery.

NERVES. Whitish cords of delicate nervous substance, which ramify through the body.

NERVINE. A medicine which soothes nervous excitement.

NERVOUS. Pertaining to a nerve.

NEURALGIA. Pain in a nerve.

NEURINE. The substance of the nerves.

NEURO-KERATIN. The substance which composes the sheath of the axis cylinder of nerves.

NEUROLOGM. Science of the nervous system.

NEURON. (G.) A nerve.

NEUROTIC. Pertaining to the nerves.

NEUROTOMA. Cutting of a nerve.

NEUTRAL. A term applied to substances which have neither the properties of an alkali or an acid; also to salts in which the base is perfectly saturated without excess of either acid or alkali.

NEUTRALIZED. Deprived of acid or alkaline qualities.

NEUTRAL SALT. A salt in which none of the properties of the acid or base are susceptible.

NI. Symbol for nickel.

NICTATION. Morbid quivering of the eyelids.

NIGER. (L.) Black.

NIGRITIES. (L.) Blackness.

NIHIL ALBUM. (L.) The oxide of zinc.

NIOBIUM. A rare metal, formerly called Columbium.

NITER. (Nitre.) The nitrate of potassium, a white crystalline salt having a pungent, saline taste. It occurs as an efflorescence on the soil in several dry, tropical countries, and can be obtained from the decomposition of animal matter in the presence of bases. It is largely used in the manufacture of gunpowder. (Called also saltpeter. See Antiseptics.)

NITRATE. A salt formed by the union of nitric acid with a base.

NITRATE OF LEAD. (See *Plumbi Nitrates*.)

NITRATE OF MERCURY. A salt obtained by dissolving mercury in nitric acid.

NITRATE OF POTASSA. (See *Niter*.)

NITRATE OF SILVER. A salt of silver obtained by dissolving the metal in nitric acid. See also *Lunar Caustic*.

NITRE. (See *Niter*.)

NITRE, CUBIC. (See *Cubic Nitre*.)

NITRIC ACID. A strongly fuming liquid, colorless when pure, obtained by distilling together saltpeter and sulphuric acid. Formula, HNO_3 .

NITRITE. A salt formed by the union of nitrous acid with a base.

NITROBENZIDE. } A product ob-

NITROBENZOLE. { tained by the action of fuming nitric acid on benzole. It is an oily, yellowish liquid, very sweet, with an odor like that of oil of bitter almonds. (See *Artificial Oil of Bitter Almonds*.)

NITROGEN. A gaseous element incapable of supporting life. (See page 111.)

NITROGENOUS. Pertaining to, or containing nitrogen.

NITRO-GLYCERINE. (Glonoin.) A very explosive substance, obtained by adding to glycerine, in small portions at a time, equal parts of strong nitric and sulphuric acids.

NITRO-PRUSSIDE OF SODIUM. A salt obtained by saturating nitroprussic acid with sodium, and evaporating. It is used as a test for alkaline sulphurets.

NITROUS ACID. An acid having the formula, HNO_2 .

NITROUS OXIDE. (Laughing Gas.) A colorless, inodorous gas possessing a slightly sweet taste. When exposed to pressure or intense cold it liquifies. When inhaled, nitrous oxide produces a peculiar intoxicating effect on the human frame, hence it has been called laughing gas.

NOCTAMBULATION. Sleep-walking.

NODE. A morbid excrescence upon bones.

NORMAL. Natural; healthy.

NORMAL SOLUTION. A normal solution contains one molecular weight in grammes, dissolved in one litre of water.

NOSOLOGY. Classification of disease.

NOSTALGIA. Home-sickness.

NOSTRUM. A quack remedy.

NUCLEIN. The chemical substance of which the cellular nuclei are composed. It may be decomposed into albumen, phosphoric acid, and adenine.

NUCLEUS. (Plural, *nuclei*.) A kernel; a center around which formation takes place; the center or growing part of a cell. (See Fig. 20.)

NUDUS. (L.) Naked.

NUTGALLS. (See Galls.)

NUTMEG. (See *Myristica*.)

NUX VOMICA. The seeds of *Strychnos nux vomica*, a small tree growing in the East. In large doses they are very poisonous. (See Poisons.)

O.

O. Symbol for oxygen.

OAKUM. A mixture of tow and hemp, used for dressing wounds.

OBCORDATE. Inversely heart-shaped.

OBESITY. Excessive corpulence.

OBFUSCATION. Paralysis of the optic nerve.

OBLIQUE. Name of certain muscles.

OBLITERATION. Disappearance of a part.

OBVATE. Inversely egg-shaped.

OBSTETRICIAN. One who practices midwifery.

OBSTETRICS. The art of treating women during and after pregnancy and delivery.

OBSTETRIX. (L.) A midwife.

OBSTRUENT. Shutting up; astringent.

OBTURATOR. Name of certain muscles which close or cover up.

OCCIPITAL. Pertaining to the back of the head.

OCCIPITO-ATLOID. Pertaining to the occiput and atlas.

OCCIPITO-FRONTALIS. A muscle under the scalp, extending from the occiput to the forehead.

OCCIPUT. The back part of the head.

OCCCLUSION. The state of being closed or hidden.

OCCULT. Secret; hidden.

OCHRA. The fore-part of the tibia.

OCHRE. An ore of iron.

OCTAHEDRAL. Having eight equal faces or sides.

OCULAR. Pertaining to the eye.

OCULIST. An eye doctor.

OCULUS. (L.) The eye.

ODONTALGIA. Tooth-ache.

ODONTIASIS. Dentition; cutting teeth.

ODONTICUS. Pertaining to the teeth.

ODONTOID. Tooth-like.

ODONTOLOGY. The anatomy of the teeth.

ODOR. A smell, fragrant or offensive.

ODORINE. A product of the re-distillation of the volatile oil, obtained by distilling bones; it has a strong odor.

(EDEMA. Tumefaction arising from serous effusion into the cellular membrane.

(ENANTHIC. Having or imparting the characteristic odor of wine.

(ESOPHAGUS. The gullet, leading from the pharynx to the stomach.

(ESOPHAGOTOMY. Opening of the gullet to remove some foreign body.

(ESOPHAGITIS. Inflammation of the œsophagus.

OFFICINAL. A term applied to such medicines as are directed by the colleges to be prepared or kept in the shops.

OFFICINAL ALCOHOL. (See Alcohol.)

OIL. An unctuous substance obtained from animal or vegetable sources. (See Fats, page 163.)

OIL OF CEDAR. (See Cedar Oil.)

OIL OF THYME. (*Oleum Thymi.*) A volatile oil used for external applications. (See Antiseptics.)

OIL OF TURPENTINE. An oil commonly called Spirits of Turpentine, prepared by distillation from common turpentine. (See Antiseptics.)

OIL OF VITRIOL. (See Sulphuric Acid.)

OIL OF WORMWOOD. A volatile oil obtained from the tops and leaves of *Artemesia absinthium*.

OIL, PALM. A yellow fixed oil, of the consistency of butter, obtained from a palm tree growing on the west coast of Africa. (See Antiseptics.)

OILS, ESSENTIAL. (Essential oils.) Oils which possess in a concentrated form the properties of the plants from which they are derived.

OINTMENT. A soft, unctuous substance which serves to anoint.

OLEAGINOUS. Resembling oil.

OLEATE. A compound of oleic acid with some base.

OLEFIANT. Forming or producing oil.

OLEFIANT GAS. Heavy carburetted hydrogen.

OLEIC ACID. An oily liquid, insoluble in water, crystallizing in needles a little below the freezing point, and having a slight smell and pungent taste.

OLEIN. (Elain.) The liquid part of oils.

OLEUM. (L.) Oil.

OLFACTORY. Pertaining to the sense of smell.

OLIBANUM. The frankincense of the ancients; a fragrant gum-resin.

OLIVARY. Olive-shaped.

OMENTITIS. Inflammation of the caul, or omentum.

OMENTUM. The caul; the peritoneal apron covering the bowels.

OMNIVOROUS. Subsisting upon both animal and vegetable food.

OMO-HYOIDES. A muscle of the neck.

OMPHALITIS. Inflammation of the navel.

OMPHALOS. (G.) The navel.

OPACITY. Property of obstructing light.

OPAQUE. Impervious to light.

OPHTHALMIA. Inflammation of the eyes.

OPHTHALMOS. (G.) The eye.

OPiate. An anodyne.

OPium. A narcotic yielded by the poppy.

OPPILATION. Obstruction.

OPPONENS. (L.) Opposing.

OPTIC. Relating to vision.

OPTICS. The science of the laws of light and vision.

ORBICULAR. Of spherical form.

ORBIT. The cavity of the eye.

ORBITAL. Pertaining to the orbit.

ORCHIS. (G.) The testicle.

ORCHITIS. Inflammation of the testicle.

ORCHOTOMY. Castration.

ORDEAL BEAN OF CALABAR. (See Poisons.)

ORE. A native mineral containing metals, salts, etc.

ORGAN. Any portion of the body having some definite function.

ORGANIC. Possessing organs.

ORGANISM. The living economy.

ORGANIZED. Endowed with life and organs.

ORGASM. A state of excitement.

ORIFICE. An aperture.

ORIGANUM. (Marjoram.) A perennial herb native of Europe and America. It contains a volatile oil which has a peculiar agreeable aromatic odor and a warm pungent taste.

ORIGIN. The fixed point or commencement of any muscle.

ORPIMENT. Yellow sulphuret of arsenic.

ORTHOPÆDIC. Relating to the removal of deformities.

OS. (L.) A bone.
 OS. (L.) The mouth.
 OS EXTERNUS. The mouth of the vagina.

OS TINCÆ. The mouth of the womb.

OSCHEAL. Pertaining to the scrotum.

OSME. (G.) Odor.

OSMIATE. A salt formed by the union of osmic acid with some base.

OSMIUM. A gray-colored metal, found in connection with platinum. Symbol, Os.

OSMOSE. (Osmosis.) The power or action whereby liquids are impelled through a moist membrane and other porous partitions.

OSMOSIS. (See Osmose.)

OSSA ALBA. (L.) The tartar occurring on the teeth, etc.

OSSARY. A repository for bones.

OSSEIN. (See Collagen.)

OSSEOUS. Bony.

OSSICULA. Little bones.

OSSIFICATION. Formation of bone.

OSTEINE. The organic matter of bone after the earthy matter has been removed.

OSTALGIA. Pain in a bone.

OSTEOCOLLA. The glue-like substance which unites fractured bones.

OSTEOGENY. The growth of bones.

OSTEOLOGY. Description of bones.

OSTEOMA. A bony tumor.

OSTEOMALACIA. A softening of the bone.

OSTEON. (G.) A bone.

OSTITIS. Inflammation of a bone.

OSTIUM. An orifice.

OTALGIA. Ear-ache.

OTIC. Pertaining to the ear.

OTITIS. Inflammation of the internal ear.

OTORRŒA. A discharge from the ear.

OTOLOGY. A treatise on the ear.

OTOPLASTY. An operation for restoring the ear.

OUNCE. The sixteenth of a pound, avoirdupois, or the twelfth of a pound, troy weight. The troy ounce

contains four hundred and eighty grains, the avoirdupois ounce four hundred and thirty-seven and a half grains.

OURON. (G.) The urine.

OVALBUMEN. The white of an egg.

OVARY. An oval body connected with the uterus by the broad ligament, one on each side, and containing a number of vesicles or ova.

OVATE. Egg-shaped.

OVIPAROUS. Bringing forth young in an egg.

OVULE. A rudimentary seed

OVUM. (L.) An egg.

OxALATE. A salt formed by the union of oxalic acid with some base.

OxALIC ACID. An acid, crystallizing in prisms, which is met with in the juices of many plants. It may be prepared by decomposing sugar by nitric acid. (See Poisons.)

OxALIS ACETOSELLA. (Wood Sorrel.) A common, perennial plant from which is obtained binoxalate of potash or salts of sorrel. (See Poisons.)

OxALURIA. Presence of oxalates in the urine.

OxAMIDE. A light, white powder, insoluble in cold water and alcohol.

OxIDATE. To convert into an oxide.

OxIDATION. The combining of a certain quantity of oxygen with metals or other substances.

OxIDE. A compound of oxygen with a metal or other substance. The term is usually applied to those compounds of oxygen which are not acids.

OxIDIZE. To convert into an oxide.

OxYACETIC ACID. (See Glycolic Acid.)

OxYCHLORIC. Consisting of oxygen and chlorine.

OxYCHLORIDE OF CALCIUM. Chlorinated lime.

OxYGEN. One of the gaseous elements. (See page 111.)

OXYGENATE. To combine with oxygen.

OXYGENATED MURIATIC ACID. Chlorine.

OXYHÆMOGLOBIN. The coloring matter of the blood as it exists in arterial blood, loosely combined with a certain quantity of oxygen.

OXYHÆMOGLOBIN, REDUCED. (Hæmoglobin.) The condition of the above during the passage of arterial into venous blood.

OXYHYDROGEN. Containing a mixture of oxygen and hydrogen.

OXYMURIATE. A chloride.

OXYOPIA. Acuteness of vision.

OXYSULPHURET. A combination of sulphur with a metallic oxide.

OXYTOXIC. Expediting delivery.

OZÆNA. An ulcer in the nose.

OZONE. Oxygen in an active or concentrated state.

OZONIC ETHER. A name for a solution of peroxide of hydrogen in ether.

OZONIDES. Oxides in which the oxygen appears to exist as ozone.

P.

P. The symbol for Phosphorus.

PABULUM. (L.) Food; aliment.

PACHYAEMA. A thick state of the blood.

PAD. A small cushion.

PAEDIATRICS. The study of the diseases of children.

PAEDOTROPIA. The nourishment of children.

PAGLIARI'S STYPTIC. A liquid said to have the property of causing an instant coagulation of the blood. It is composed of a tincture of benzoin combined with alum.

"PAKFONG." The white copper of the Chinese.

PALATAL. Pertaining to the palate.

PALATE. The roof of the mouth.

PALATOPHARYNGEUS. Muscle of the palate.

PALEACEOUS. Chaffy.

PALLADIUM. A gray metal, of fibrous structure, discovered in 1803.

PALLIATIVE. Medicines affording relief without curing.

PALLOR. Paleness.

PALMA. (L.) The palm of the hand.

PALMAR. Belonging to the palm of the hand.

PALMAR ARCH. A name given to the branches of the radial and ulnar arteries, which cross the palm of the hand.

PALMARIS. (L.) Pertaining to the palm of the hand.

PALMARIS BREVIS. } Muscles of
PALMARIS LONGUS. } the palm of the hand.

PALMATE. A salt formed by the union of palmic acid with some base.

PALMIC ACID. (Ricinelaïdic Acid.) An acid obtained by the saponification of Palmin.

PALMIN. A fatty substance obtained by the action of nitrous acid on castor oil.

PALMITIC ACID. An acid obtained by the saponification of palmitin.

PALMITIN. A peculiar constituent of palm oil.

PALM WINE. A liquor obtained by the fermentation of the juice of the palm tree. It was used by the Egyptian embalmers to cleanse the cavity of the abdomen. (See Antiseptics.)

PALPABLE. That can be apprehended by touch.

PALPATION. Touching; exploring by the hand.

PALPITATION. Morbid mobility of the heart.

PALSY. Local paralysis.

PALUDAL. Pertaining to a swamp.

PANACEA. A universal remedy.

PANCREAS. A gland seated behind the stomach which secretes the pancreatic juice. (See page 199.)

PANCREATIC. Belonging to the pancreas.

PANCREATIC DUCT. The canal from the pancreas to the duodenum.

PANCREATIC JUICE. The secretion from the pancreas. (See page 199.)

PANCREATIN. A substance obtained from the pancreatic juice, having the power of converting starch into sugar.

PANDEMIC. Endemic.

PAPILLA. A small nipple-shaped projection.

PARA-ALBUMEN. A modified form of albumen, found in the liquid of dropsical ovaries.

PARACELSUS. A celebrated Swiss physician, who lived at the close of the fifteenth century.

PARACENTESIS. Tapping.

PARACINESIS. Disease of the motor nerves.

PARACUSIS. Diminution of hearing.

PARAFFIN. } A white translu-

PARAFINE. } cent substance resembling sperma-ceti, obtained from the distillation of tar. It offers great resistance to chemical action.

PARALACTATE. A compound formed by the union of paralactic acid with some base.

PARALACTIC ACID. (See page 175.)

PARALBUMEN. (See page 177.)

PARALYSIS. Loss of motion or sensation.

PARANAPHTHALINE. (Anthracene.) A substance resembling naphthaline found in coal tar.

PARAPLEGIA. Paralysis of the lower half of the body.

PARARCHISTS. The Egyptian priests whose office it was to make the necessary incisions upon a body for embalming it.

PARASITICAL. Growing out of, or living upon other bodies.

PARATARTARIC ACID. (Uvic Acid.) An acid found in small proportion in the juice of grapes.

PARENCHYMA. The soft, cellular tissue of plants or glandular organs.

PARIES. (L.) A wall.

PARIETAL. Pertaining to the side or wall.

PARIETES. (L.) Walls.

PAROSMIA. Perversion of smell.

PAROTID. Near the ear: name of salivary glands.

PAROTITIS. The mumps.

PAROXYSM. A fit of disease recurring periodically.

PARTURITION. Delivery of young.

PARTUS. (L.) Labor.

PARULIS. Gum-boil.

PASSIVE. The opposite of active.

PASTIL. } A small, aromatic

PASTILLE. } cone to be burned for cleansing and scenting the air of a room.

PATELLA. The knee-pan.

PATENT. Apparent; manifest.

PATHEMA. (G.) Passion; affection.

PATHETICUS. (L.) Relating to the passions.

PATHOGENESIS. Production of disease.

PATHOGENETIC. Disease-producing.

PATHOGENIC. Belonging to pathogeny.

PATHOGENY. That part of pathology which relates to the origin and development of disease.

PATHOGNOMIC. Indicative of disease.

PATHOLOGICAL ANATOMY. Morbid anatomy.

PATHOS. (G.) Disease; affection.

PATHOLOGY. The consideration of diseases.

PATULOUS. Spreading open.

Pb. Symbol for lead. (Plumbum.)

Pd. Symbol for palladium.

PEARL ASH. A carbonate of potassa, obtained by calcining potash.

PEAT CHARCOAL. A disinfectant obtained by charring peat.

PECTINALIS. A muscle of the thigh.

PECTINATED. Shaped like comb teeth.

PECTORAL. Pertaining to the breast.

PELAGRA. Elephantiasis.

PELARGONIC ACID. An acid, most conveniently formed by the action of nitric acid on oil of rue. (See page 263.)

PELLICLE. A thin skin or crust.

PELLIS. (L.) The skin.

PELVIS. The open, bony structure at the lower extremity of the trunk, inclosing the internal urinal and genital organs.

PEMMICAN. An alimentary substance, containing much nutriment in a small bulk, made by mixing equal weights of buffalo meat and buffalo tallow. Thus prepared, pemmican may be kept almost indefinitely.

PENDULOUS. Hanging down.

PENIS. The male organ of generation.

PENNE'S ANTISEPTIC LIQUID. A preparation produced by adding two parts of hydrobromic acid to eight parts of pure carbolic acid, contained in a porcelain capsule placed on a sand or steam bath.

PEPSIN. } The distinct organic

PEPSINE. { principle of the gastric juice.

PEPTIC. Digestive.

PEPTONE. (See page 181.)

PER. A prefix used in chemical composition to denote excess, or that the substance first mentioned in the name of the compound enters in a greater proportion than the other.

PERACUTE. Very sharp.

PERCHLORATE. A compound of perchloric acid and a base.

PERCHLORIC ACID. An acid containing two equivalents of chlorine to seven of oxygen.

PERCHLORIDE OF CARBON. An erroneous name applied to chloroform from the impression prevalent, when first obtained, that it consisted exclusively of chlorine and carbon.

PERCHLORIDE OF IRON. Ferric Chloride. (See Antiseptics.)

PERCHLORIDE OF MERCURY. Corrosive Sublimate. (See Antiseptics.)

PERCHLORIDE OF THALLIUM. A compound isomorphous with the alkaline perchlorides, which it equals in stability. It is slightly soluble in alcohol, and may be heated to nearly the boiling-point of mercury without decomposition.

PERCHROMIC ACID. An acid consisting of two equivalents of chrome and seven of oxygen.

PERCOLATION. The act or process of percolating, or filtering, or of passing through small interstices, as liquor through any substance.

PERCUSSION. Physical examination of a cavity by striking its walls.

PERICARDIUM. The sac containing the heart.

PERICHONDRIUM. The membrane covering the cartilages.

PERICRANIUM. The membrane investing the skull.

PERINEAL. Relating to the perineum.

PERINEUM. The part between the anus and organs of generation.

PERIOD. A stated time.

PERIODICITY. Regularity of recurrence.

PERIOSTEUM. Membrane investing the bones.

PERIPHERY. The circumference.

PERIPYEMIA. A collection of pus.

PERISTALTIC. A term applied to the peculiar movement of the intestines, like that of a worm in its progress; hence also called *vermicular* motion.

PERISTROMA. The mucus coat of the intestines.

PERITONEAL SAC. The peritoneum.

PERITONEUM. The serous membrane lining the abdomen, and enveloping its organs.

PERITONITIS. Inflammation of the peritoneum.

PERMANGANATE OF POTASH. (See *Potassæ Permanganas*.)

PERONEAL. Relating to the fibula.

PEROXIDE. That oxide of a given base which contains the greatest quantity of oxygen.

PEROXIDE OF HYDROGEN. (See Hydrogen Peroxide and Antiseptics.)

PERSULPHATE OF IRON. (Mon-sel's.) A salt of iron consisting of two equivalents of the sesquioxide of iron and five of sulphuric acid.

PERTURBATION. Disturbance.

PERTUSSIS. Whooping-cough.

PERVERSION. A morbid change.

PERVIGILIUM. (L.) Want of sleep.

PES. (L.) The foot.

PESSARY. An instrument to support the womb.

PETININ. An organic base contained in Dippel's animal oil.

PETRIFACTION. A changing into stone.

PETROLEUM. (Rock Oil.) Petroleum is a term applied to all the native liquid substances belonging to the class of bitumens. They exist in nature either isolated or combined with carbon, in various proportions, forming the different kinds of bituminous coal.

PETROUS. Stony; hard.

PHALANGES. Bones of the fingers and toes.

PHANTASY. Morbid imagination.

PHARMACEUTIC.	} Pertaining to the art of preparing medicines.
PHARMACEUTICAL.	

PHARMACON. A medicine.

PHARMACOPŒIA. A standard book or treatise describing the preparations of the several kinds of medicines which are regarded as official.

PHARMACY. The art of preparing and combining medicines.

PHARYNGEAL. Belonging to the pharynx.

PHARYNGITIS. Inflammation of the pharynx.

PHARYNGOTOMY. Cutting into pharynx.

PHARYNX. The top of the œsophagus.

PHENATE. A salt formed by the solution of a phenol in an alkali.

PHENE. (See Benzine.)

PHENIC ACID. An old name for carbolic acid. (See Antiseptics.)

PHENIC ACID VINEGAR. A compound recommended as a disinfectant against pestilence, consisting of acetic acid, camphor and phenic acid.

PHENOL. (See Carbolic Acid.)

PHENOMENON. (Plural, Phenomena.) A remarkable or wonderful occurrence.

PHENYL. A compound radical, whose hydrated oxide constitutes carbolic acid. Formula ($C_6 H_5$)¹.

PHENYLIC ACID. (See Carbolic Acid and Antiseptics.)

PHENYLIC ALCOHOL. (See Phenic Acid.)

PHILOPROGENITIVENESS. Love of children.

PHLEBITIS. Inflammation of the veins.

PHLEBOTOMY. Bleeding from a vein.

PHLEGM. Mucus from the bronchial tubes.

PHLEGMASIÆ. Inflammations.

PHLEGMON. A boil.

PHLOGISTIC. Inflammatory.

PHLOGISTON. An imaginary principle by which certain chemists accounted for the phenomena of combustion.

PHONICA. Diseases of the organs of speech.

PHOSGENE. Generating light; name given to a certain gas generated by the action of sunlight or bright daylight on chlorine and carbonic acid.

PHOSPHATE. A salt formed by a combination of phosphoric acid with a salifiable base.

PHOSPHATE OF IRON. (See *Ferri Phosphas*.)

PHOSPHATE OF LIME, PRECIPITATED. (See *Calcis Phosphas Pre-*

cipitata and Chemistry of the Human Body.)

PHOSPHATE OF POTASSA. (See Chemistry of the Human body)

PHOSPHITE. A salt formed by the combination of phosphorous acid with a salifiable base.

PHOSPHOGLYCERIC ACID. An acid obtained by the action of baryta water on lecithin, a constituent of the bile.

PHOSPHORETTED HYDROGEN. (See Phosphuretted Hydrogen.)

PHOSPHORIC ACID. (Dimeta.) An acid obtained from bones. Symbol H_3PO_4 .

PHOSPHOROUS ACID. An acid formed by the treating of oxidized phosphorous with water. Symbol H_3PO_3 .

PHOSPHORUS. One of the elements. (See page 111.)

PHOSPHURET. Combination of phosphorus with a metal.

PHOSPHURETTED HYDROGEN. (Phosphoretted Hydrogen.) (See page 221.)

PHOTAGENE. An empyreumatic oil obtained from the tar of turf, bituminous coal, etc., thin, and of great illuminating power.

PHOTOPHOBIA. (G.) Dread of light.

PHRENIC. Pertaining to the diaphragm.

PHRENITIS. Inflammation of the brain.

PTHISIS. Wasting.

PTHISIS PULMONALIS. Consumption of the lungs.

PHYMOSIS. Contraction of the prepuce.

PHYSICS. Science of natural phenomena.

PHYSIOLOGY. The science which treats of the organs of the body and their functions.

PIAL. Relating to the Pia Mater.

PIA MATER. (L.) A thin membrane investing the brain.

PICAMAR. A colorless, odorous

liquid constituting the bitter principle of rectified oil of tar.

PICKLE. A strong brine.

PICOLIN. A colorless liquid, having the odor of ammonia and pepper, and a caustic taste, obtained from Dippel's animal oil.

PICRATE OF POTASSA. A salt formed by saturating picric acid with hydrate of potassa.

PICRIC ACID. (See Carbazotic Acid.)

PICROMEL. A characteristic principle of bile.

PIGMENT. A paint or varnish.

PIGMENTUM NIGRUM. (L.) Black pigment upon the choroid coat of the eye.

PILES. Tumors or enlarged veins in the neighborhood of the anus.

PILUS. Hair.

PIMELOSIS. Fatty degeneration of the liver.

PINEAL GLAND. A body in the brain about the size of a pea, supposed by Descartes to be the seat of the soul.

PINEY. A fatty substance resembling tallow, obtained from an East Indian plant.

PINT. The eighth part of a gallon.

PINUS. (L.) The pine tree.

PINUS CEDRUS. The source of cedria.

PINUS SYLVESTRIS. The source of European turpentine.

PIPETTE. A small glass tube with a bulb in the middle, used for transferring fluids.

PITCH. (*Piz.*) The product left after the evaporation of tar. It has been used in various cutaneous diseases and is antiseptic.

PITCH, BURGUNDY. (See Burgundy Pitch.)

PITCH, CANADA. (See Canada Pitch.)

PITH. The soft and spongy substance in the center of many plants and trees; the medulla.

PITUITA. (L.) Phlegm.

PITUITARY MEMBRANE. The lining of the nostrils.

PIX. } (See Pitch.)
PIX ARIDA. }

PIX BURGUNDICA. (See Burgundy Pitch.)

PIX LIQUIDA. (Tar.) The impure turpentine, procured by burning the wood of *Pinus palustris*, and other species of pine.

PIX NIGRA. (L.) (See Pitch.)

PLACENTA. The structure nourishing the fetus in the womb during gestation.

PLAGUE. A pestilential fever, prevailing in Egypt and other eastern countries.

PLANTA. (L.) The sole of the foot.

PLANTAR. Belonging to the sole of the foot.

PLASMA. (*Liquor Sanguinis*.) The fluid part of the blood.

PLASTER OF PARIS. (See *Calcis Sulphas*.)

PLASTIC. Forming; molding.

PLASTIC SURGERY. Operations for the removal of deformities.

PLATINUM. A white-colored, untarnishable metal, very infusible, and insoluble in ordinary acids. It is generally found alloyed with other metals. Symbol, Pt.

PLATINUM BLACK. Metallic platinum in the form of a black powder obtained by passing an electric current through the chloride.

PLATINUM SPONGE. (Spongy Platinum.) A metallic platinum in the form of a porous, dull-brown mass, used in chemical experiments.

PLETHORA. Excessive fullness.

PLEURA. The serous lining of thorax, covering the thoracic viscera.

PLEURALGIA. Pain in the side.

PLEURISY. } Inflammation of
PLEURITIS. } the pleura.

PLEURO-PNEUMONIA. A combination of pleurisy and pneumonia.

PLEXIMETER. A flat plate used in percussion of the chest.

PLEXUS. (L.) A net-work of nerves or vessels.

PLICA. (L.) A fold.

PLUGGING. Introduction of lint or some other substance to stop hemorrhage.

PLUMBAGO. (See Black Lead.)

PLUMBATE OF SODA. A deodorizer for petroleum oils, obtained by boiling litharge with caustic soda.

PLUMBI ACETAS. (L.) Acetate of lead. (See Antiseptics.)

PLUMBI CARBONAS. Carbonate of lead. (See Antiseptics.)

PLUMBI NITRAS. Nitrate of lead. A salt obtained by treating litharge with nitric acid.

PLUMBUM. (L.) Lead.

PLUVIOMETER. A rain-gauge.

PNEUMA. (G.) Air.

PNEUMATIC. Pertaining to air or gaseous fluid.

PNEUMATICA. Diseases of the respiratory organs.

PNEUMATICS. The science of elastic fluids.

PNEUMATOMETER. An instrument for measuring the amount of air inhaled at a single breath.

PNEUMATOSIS. A windy swelling.

PNEUMIC. Belonging to the lungs.

PNEUMOGASTRIC. Pertaining to the lungs and stomach.

PNEUMONAEMIA. Congestion of blood in the lungs.

PNEUMONIA. Inflammation of the lungs.

PNEUMONIC. Pertaining to the lungs; pulmonary.

PNEUMOTHORAX. An accumulation of air in the chest.

POCK. A pustule or variola.

POCULIFORM. Cup-shaped.

PODAGRA. Gout in the joints of the foot.

PODAGRIC. Pertaining to gout.

PODALGIA. Pain in the foot.

PODARTHRTIS. Inflammation of the joints of the foot.

POINTING OF AN ABSCESS. The

conical softish projection, of a light-yellow color, observable in an abscess when nearly ready to discharge.

POISON. A substance which, when introduced into the animal system, causes such a change in the animal economy as to produce disease or death.

POLIOSIS. Premature grayness.

POLLEX. (L.) The thumb; the great toe.

POLYBASIC. Having, or being combined with several bases.

POLYCHROMATIC. Many-colored.

POLYCYSTIC. Consisting of many cysts.

POLYDACTYLISM. The state of having a superfluous finger or toe.

POLYDIPSIA. Excessive thirst.

POLYGALACTIA. Excessive secretion of milk.

POLYMERISM. The principle according to which a diversity of compounds exist under a common formula.

POLYPOPIA. Multiple vision.

POLYPHAGIA. Voracity.

POLYPHARMACIA. The administration of too many medicines.

POLYPUS. A variety of tumor found in the nose, uterus or vagina.

POLYSARCOUS. Obese.

POMATUM. A perfumed ointment for the hair.

POMIFORM. Having the shape of an apple.

POMUM. (L.) An apple.

POMUM ADAMI. (L.) Adam's Apple. The angular projection on the fore part of the neck, caused by the anterior part of the thyroïd cartilage.

PONDERABLE. That which can be weighed.

PONS. (L.) A bridge.

POPLES. (L.) The back part of the knee joint.

POPLITEÆUS. (L.) *Popliteal.* The name of a muscle inserted into the superior triangular surface at the back of the tibia, and which bends the thigh and leg.

POPLITEAL. Pertaining to the ham.

POPLITEAL ARTERY. A continuation of the femoral artery which descends a little obliquely outward into the hollow of the ham, and extends from the commencement of the lower third of the thigh to the end of the upper quarter of the leg.

PORE. A small opening at the end of a vessel on the surface of an organized body; also a small interstice between the particles of matter which compose bodies.

POROSITY. The property of having pores.

POROUS. Having pores, or full of pores.

PORTA. (L.) A door; a gate.

POST MORTEM. (L.) After death; a term applied to the examination of a dead body.

POSTURE. Position of the body.

POTABLE. Fit to drink.

POTASH. (Potassa.) The monoxide of potassium. It is a powerful alkali and exists in various states of purity.

POTASSA. (See Potash.)

POTASSA ALUM. (See Alumina and Ammonia Sulphate.)

POTASSA HYDRIODATE. An obsolete name for iodide of potassium.

POTASSA HYPERMANGANATE. (See *Potassæ Permanganas.*)

POTASSA CARBONATE PURE. (See Carbonate of Potassa, and Antiseptics.)

POTASSA QUADROXALATE. Essential Salt of Lemons. (See Poisons.)

POTASSA SESQUICARBONATE. (See Antiseptics.)

POTASSA SILICATE. (Silicate of Potassa.) A salt known in commerce as *soluble glass*.

POTASSÆ PERMANGANAS. (Permanganate of Potash.) A powerful disinfectant occurring in the form of slender purplish crystals. (See Antiseptics.)

POTASSIUM. One of the metallic elements. (See page 111.)

POTATO OIL, SPIRIT OF. (See Alcohol, Amylic.)

POTENTIAL. Powerful.

POTION. A medicine to be swallowed in fluid form.

POTOMANIA. (*Mania a Potu.*) Drink madness.

POUND. A legal standard of weight; the troy pound contains 12 ounces, the avoirdupois, 16; so that 144 pounds avoirdupois equal 175 pounds troy.

POUPART'S LIGAMENT. The crural arch.

PRACTITIONER. A physician who devotes himself to the practice of medicine.

PRÆCORDIA. (L.) The fore part of the thoracic region.

PRECIPITANT. Casting down; applied to the substance by the addition of which a precipitate is formed.

PRECIPITATE. The substance which sinks down in the process of precipitation.

PRECIPITATION. The act of throwing to the bottom of a vessel any substance held in solution.

PRECOCIOUS. Premature.

PRECURSOR. A forerunner.

PREDISPOSING. A term applied to a condition of body which renders a person liable to disease.

PREDORSAL. In front of the spine.

PREGNANCY. The state of being with child.

PREGNANT. With child.

PREHENSION. Seizing.

PREMONITORY. Warning beforehand.

PREPUCE. The cutaneous fold which covers the *glans penis*.

PREPUTIAL. Pertaining to the prepuce.

PRESBYOPIA. Far-sightedness.

PRESCRIPTION. A recipe.

PRIMARY. Original; principal.

PRINCIPLE. An original element contained in other substances from which it may be obtained by analysis.

PRINCIPLE, PROXIMATE. (See Proximate Principle.)

PROBE. An instrument for trying the depth, extent and direction of wounds, etc.

PROBING. Examining with the probe.

PROCESS. A projecting point or eminence of a bone; a protuberance.

PROCIDENTIA. (L.) The falling down of some part.

PROCLIVITY. Disposition; tendency.

PROCTAGRA. Pain at the anus.

PROFOUND. Deep.

PROFUSE. Abundant.

PROGNOSIS. The forecasting of a disease, drawn from a consideration of its signs and symptoms.

PROLAPSUS. (L.) A protrusion and falling down.

PROLIFIC. Fertile.

PROMINENCE. A projection.

PROOF SPIRIT. A spirit made by mixing five parts of alcohol with three parts of distilled water.

PROOF VINEGAR. The strongest kind of vinegar, containing five per cent of acetic acid.

PROPAGATION. Reproduction.

PROPERTY. Quality; attribute.

PROPHYLACTIC. Preserving health or preventing disease.

PROPIONIC ACID. (See page 261.)

PROPYL. A hydrocarbon radical (C_3H_7)¹.

PROPYLAMINE. (See page 266.)

PROSTATE GLAND. The gland below the neck of the bladder.

PROSTATIC. Pertaining to the prostate gland.

PROSTATITIS. Inflammation of the prostate gland.

PROSTRATION. Extreme feebleness or exhaustion.

PROTAGON. A phosphoretted, fatty compound, which is supposed to be the chief constituent of nervous tissue. (See Lecithin.)

PROTEIN. A compound of oxygen, hydrogen, carbon and nitrogen, forming the basis of the most important constituents of animal fibrin, albumen, etc.

PROTO. A prefix denoting the first degree of combination.

PROTOPLASM. The nitrogenous substance from which the cell-nucleus is formed.

PROTOSALT. A salt containing a metallic protoxide.

PROTOSULPHATE. A compound of sulphuric acid with a protoxide.

PROTOXIDE. When there are several oxides of the same substance, the protoxide is that which is first in the scale, or which has the smallest quantity of oxygen.

PROTOXIDE OF NITROGEN. (See Nitrous Oxide.)

PROXIMATE PRINCIPLES. Those distinct compounds which exist ready formed in animals and vegetables. (See p. 154.)

PRURIENT. Itching.

PRURIGO. (L.) The itch.

PRURITUS. (L.) Itching.

PRUSSIATE. A compound of prussic acid with a base.

PRUSSIC ACID. Hydrocyanic acid; a violent poison.

PSEUDO. (G.) A prefix signifying *false*.

PSEUDOBLEPSIA. False vision.

PSOAE. Two pairs of muscles of the loins.

PSORA. (G.) The itch.

PSORIASIS. A cutaneous disease, characterized by a rough, scaly cuticle.

PSORIC. Pertaining to the itch.

PSYCHICAL. Pertaining to the intellect.

PSYCHOSIS. Affection of the mind.

PTARMIC. Causing to sneeze.

PTOAMINES. (Septicene.) Alkaloids obtained from animal tissues in complete or incipient putrefaction.

PTOSIS. A falling.

PTYALAGOGUE. Increasing the flow of saliva.

PTYALIN. A principle peculiar to saliva, upon which its faint sickly odor depends. It has the property of turning starch into sugar.

PUBERTY. The marriageable age.

PUBES. (L.) The external part of the generative region.

PUBESCENCE. Fine hair or down.

PUBIC. Pertaining to the pubes.

PUDENDA. (L.) Genital organs.

PUERILE. Relating to childhood.

PUERPERAL. Connected with child-bearing.

PUERPERAL FEVER. A severe disease sometimes occurring soon after child-birth.

PULMONARY. Pertaining to the lungs.

PULMONIC. Pulmonary.

PULMONITIS. Inflammation of the lungs.

PULSATION. A throbbing sensation.

PULSE. The beating of the arteries, following the contractile action of the heart.

PULSIMETER. An instrument for measuring the force or frequency of the pulse.

PULVERIZE. To reduce to fine powder.

PULVIS. (L. Plural, *Pulveres*.) A powder.

PUMICE. A porous volcanic product, consisting chiefly of silica and alumina.

PUMICIFORM. Resembling pumice-stone.

PUNCTURE. A perforation made by a pointed instrument.

PUNGENT. Acute; sharp; penetrating.

PUNK. A species of fungus used as tinder.

PUPIL. The round, black opening in the center of the iris.

PURE. Separate from all extraneous matter.

PURGATIVE. Cathartic.

PURIFORM. Resembling pus.

PURKINJE, GRAY SUBSTANCE OF. (See page 58.)

PURPURATE. A compound of purpuric acid with a base.

PURPURIC ACID. An acid having a purple color, formed by the action

of nitric acid upon the lithic or uric acid.

PURULENT. Consisting of pus.

PUS. A bland, cream-like fluid found in abscesses, or on the surface of sores; matter.

PUSTULATE. Having pustules.

PUSTULE. A vesicle of the skin containing pus.

PUTREFACTION. The spontaneous decomposition of animal or vegetable matter.

PUTRIDITY. The first and most poisonous stage of putrefaction.

PYÆMIA. Purulent blood. Blood-poisoning.

PYÆMIC. Relating to pyæmia.

PYARTHROSIS. Suppuration of a joint.

PYELITIS. Inflammation of the pelvis of the kidney.

PYEMIA. (See Pyæmia.)

PYEMIC. (See Pyæmic.)

PYLORIC. Pertaining to the pylorus.

PYLORUS. The inferior aperture of the stomach, at the commencement of the duodenum.

PYOGENESIS. The secretion of pus.

PYOGENIC. Secreting pus.

PYOTHORAX. A collection of pus in the thorax.

PYRE. A structure of firewood, upon which the bodies of the dead were cremated.

PYRENE. A volatile oil obtained from coal tar.

PYRETIC. Pertaining to fever.

PYREXIA. The state of fever.

PYRIDINA. An artificial alkaloid obtained by the action of potassa upon cinchonia.

PYRO. A prefix, denoting some quality or effect of heat.

PYROACETIC ACID. Acetic acid exposed to the action of heat.

PYROGALLIC ACID. A bitter solid obtained by the distillation of gallic acid.

PYROLIGNEOUS ACID. An acid obtained from the destructive distil-

lation of wood. It consists of acetic acid mixed with empyreumatic oil and bitumen, and possesses some antiseptic value.

PYROLIGNEOUS SPIRIT. (See Alcohol, Methylic.)

PYROLIGNEOUS VINEGAR. (See Crude Pyroligneous Acid.)

PYROMETER. An instrument for measuring very high degrees of heat.

PYROPHOSPHORIC ACID. A compound of phosphorus, oxygen, and water, obtained by heating ordinary phosphoric acid.

PYROSIS. Water-brash, heart burn.

PYROTARTRATE. A salt formed by the union of pyrotartaric acid with some base.

PYROURIC ACID. An acid obtained by distilling uric acid.

PYROXYLIC. Obtained by the destructive distillation of wood.

PYROXYLIN. Gun-cotton.

PYRROL. A volatile principle obtained from coal-tar.

PYRROLIN. An artificial alkaloid formed by the action of potassa on cinchonia.

PYURIA. The emission of purulent urine.

Q.

QUACK. A charlatan; a pretender to medical skill.

QUADRATE. Of a square figure; a name applied to certain muscles on account of their shape.

QUADRIBASIC. Having four parts of base to one of acid.

QUADRIHYDRATED NITRIC ACID. Nitric acid of the specific gravity 1.42. It contains one equivalent of dry acid, and four of water.

QUADROXIDE. An oxide in which four equivalents of oxygen are combined with one equivalent of some other element.

QUALITATIVE ANALYSIS. } (See
QUANTITATIVE ANALYSIS. } Analysis.)

QUANTUM SUFFICIT. Q. S. (L.)

A sufficient quantity.

QUART. The fourth part of a gallon.

QUICKENING. The period of gestation when the movement of the fetus is first perceptible.

QUICKLIME. (*Calx vivum*.) Unslaked, or unquenched lime.

QUICKSILVER. (See Mercury.)

QUINIA. } An alkaloid, ob-
QUININE. } tained from various
species of Cinchonia. (See Anti-septics.)

QUINTESSENCE. Concentrated essence.

Q. V. (*Quantum vis*. L.) As much as you will.

R.

R. (L. *Recipe*, "take.")

RABID. Affected with hydrophobia.

RACHITIS. (See Rickets.)

RADIATING. Diverging or spreading from a common point.

RADICAL. See page 122. A negative combined with hydroxyl, which is regarded as the acidifying principle, form acids.

RADICAL VINEGAR. (See Acetic Acid, Glacial.)

RADIUS. One of the bones of the forearm.

RADIX. (L.) The root of a plant.

RAMIFICATION. The division of a stem into branches.

RAMIFIED. Divided into branches; branched.

RAMIFORM. Resembling a branch.

RANCID. A term applied to fat, oil, or any greasy body which, by absorbing oxygen from the air, has acquired a strong odor and disagreeable taste.

RANGOON PETROLEUM. } (See
RANGOON TAR. } Naphtha.)

RAPTUS. (L.) A forcible seizure.

RARE. Thin; subtile.

RASH. Eruption on the skin.

RATIONAL. Conformable to reason, or a well-reasoned plan.

REACTION. The state or process of applying a reagent, or test, for detecting the presence of certain other bodies.

REAGENT. A substance employed in chemical analysis to ascertain the quantity or quality of the component parts of bodies by reacting on their elements. A test.

REALGAR. "Red Arsenic." (See Arsenic Bisulphuret.)

RECEIVER. A vessel fitted to a retort; an alembic, or the like, for receiving the product of distillation.

RECIPE. A word constantly used in the abbreviated form, R., as the commencement of a medical prescription.

RECRUDESCENCE. A growing worse again.

RECRYSTALLIZATION. The process of a second crystallization.

RECTALGIA. Pain of the Rectum.

RECTIFIED. Refined; purified by repeated distillations.

RECTIFIED SPIRIT. (See Alcohol.)

RECTITIS. Inflammation of the rectum.

RECTUM. The last, nearly straight, portion of the great intestine, terminating at the anus.

RECTUS. Straight; a name given to certain muscles.

RECUPERATION. Recovery.

RECUPERATIVE. Tending to recovery.

RECURRENCE. A return.

RECURVATION. A bending backward.

RED CHARCOAL. A charcoal intermediate in its properties between wood and ordinary charcoal.

RED CHROMATE OF POTASSA. (See Bichromate of Potassa.)

RED IODIDE OF MERCURY. (See Biniodide of Mercury.)

RED PRUSSIATE OF POTASH. (See Ferricyanide of Potassium.)

REDUCING. (See Reduction.)

REDUCTION. In surgery the returning a dislocated bone into its natural situation; in chemistry, the process by which metals changed or disguised by a union with other substances, are restored to their metallic state.

REFINE. To reduce to a pure or fine state.

REFLUX. The return of the blood from the head, or lower part of the body, to the heart.

REFRACTORY. Difficult to melt, as platinum.

REFRIGERANT. A remedy which cools the body or blood.

REGELATION. The act or process of freezing anew.

REGENERATION. The reproduction of a part lost by disease, or injury.

REGULUS. A pure metal reduced from its ore.

REGURGITATION. A flowing back; flowing the wrong way.

REINS. The kidneys.

RELAPSE. The return of adisease which has apparently ceased.

RELAXTION. Want of tone.

RENAL. Belonging to the kidney.

RENITENT. Resisting pressure.

RENNET. A fluid made by infusing the rennet-bag, or inner membrane of a calf's stomach, in hot water; it has the property of coagulating milk.

RENOVATION. Renewal; restoration.

REPELLENT. Driving back from the surface.

REFLETION. The state of being full.

REPRIMENTS. Remedies for fluxes.

RESERVOIR. A cavity or cistern, in which water or other liquid is accumulated.

RESIDUAL. Remaining behind.

RESIN. (Rosin.) A solid, inflammable substance, of vegetable origin; a non-conductor of elec-

tricity, and insoluble in water, but soluble in alcohol and essential oils. It is the residue after the distillation of volatile oil from turpentine.

RESIN OIL. An oleaginous product resulting from the destructive distillation of resin.

RESINA. (L.) Resin.

RESINA NIGRA. (L.) (See Pitch.)

RESOLUTION. Analysis; decomposition.

RESORCIN. An unstable compound of iodine.

RESPIRATION. The function of breathing.

RESPIRATORY. Pertaining to respiration.

RESUSCITATION. The restoring to life of those apparently dead.

RETARDATION. A stopping or hindering.

RETE MUCOSUM. (L.) "Mucous network." A mucous substance between the derma and the epidermis, containing the coloring matter of the skin.

RETENTION. The stoppage of any of the excretions, especially the urine.

RETICULAR. Net-like.

RETICULATE. Having distinct veins or lines crossing like network.

RETICULATION. State of being reticulate.

RETINA. The most internal membrane of the eye, being an expansion of the optic nerve.

RETINITIS. Inflammation of the retina.

RETORT. A vessel made of glass, earthenware, or iron, for the purpose of distillation.

RETRACTION. The shortening of a broken limb.

RETRAHENS. (L.) Drawing back.

RETROCESSION. A retrograde movement.

RETROPHARYNGEAL. Pertaining to parts behind the pharynx.

RETROVERSION. Backward displacement of organs.

RHACHIALGIA. Pain in the spine.

RHACHIS. (G.) The spine.

RHACHITIS. (See Rickets.)

RHEUMATISM. Inflammation of the fibrous tissues of the larger joints.

RHIGOLENE, { A variety of pe-

RHIGOLIN. { troleum naphtha.

It is obtained by distilling petroleum, and separating the liquids of the least gravity, by redistillation, until a liquid is obtained which boils at about 70°.

RHINORRHAGIA. Bleeding from the nose.

RHODIUM. A hard, white, brittle metal discovered in 1803.

RHYTHM. A measured movement.

RICKETS. A disease of children, characterized by a large head, crooked spine and limbs, tumid abdomen and general debility.

RICINOLEIC ACID. An acid resulting from the decomposition of saponified castor oil by an acid.

RIGIDITY. Stiffness.

RIGOR. A sudden coldness, with shivering.

RIMA. A fissure or opening.

RINSE. To wash lightly.

RISUS. (L.) Laughter.

ROCHE ALUM. A rose-colored alum, which occurs in fragments about the size of an almond.

ROCHELLE SALT. Tartrate of potash and soda.

ROCK SALT. The solid state in which salt is mined.

ROLLER. A long bandage.

ROLL SULPHUR. Brimstone.

ROMAN ALUM. The purest variety of alum found in commerce.

ROMAN VITRIOL. (See *Cupri Sulphas*.)

ROSAE OLEUM. (L.) (See Attar of Roses.)

ROSEOLA. Eruption of small red pimples.

ROSIN. (See Resin.)

ROSOLIC ACID. An acid obtained by the oxidation of carboic acid.

ROTULA. (L.) The knee-pan.

ROTUNDUS. (L.) Round.

ROUGE. A cosmetic powder prepared by mixing carmine with powdered tale.

RUBEFACTENTS. Agents producing redness of the skin.

RUBEOLA. The measles.

RUBIDIUM. A rare metal.

RUGA. (L. Plural, *Rugæ*.) A wrinkle.

RUGOSE. Wrinkled.

RUM. A spirit distilled from cane juice.

RUPTURE. The popular name for hernia.

RUTHENIUM. A hard gray metal occurring in platinum ore.

RUYSCH, MEMBRANE OF. The internal layer of the choroid coat of the eye.

S.

S. Symbol for sulphur.

SABULOUS. Sandy; gritty.

SAC. A bag; a cyst.

SACCHARATE. A salt formed by the union of saccharic acid with some base.

SACCHARINE FERMENTATION. The change by which starch is converted into sugar.

SACCHARUM. (L.) Sugar.

SACCHARUM SATURNI. (L.) (See Acetate of Lead.)

SACCULAS. (L.) A little sac.

SACRAL. Pertaining to the sacrum.

SACRUM. The posterior bone of the pelvis, sustaining the spinal column.

SAINT ANTHONY'S FIRE. Erysipelas.

SAINT VITUS' DANCE. Chorea.

SAL. (L.) Salt.

SAL AERATUS. A salt between a carbonate and a bicarbonate of potassa.

SAL AERATUS, SODA. Bicarbonate of soda, prepared in breweries by placing the carbonate in vessels over the fermenting beer in the vats.

SAL ALEM BROTH. A double salt, consisting of the chlorides of ammonia and mercury. (See Antiseptics.)

SAL AMMONIAC. (See Ammonia Hydrochlorate.)

SAL DIURETICUS. Acetate of potassa.

SAL ENIXUM. The sulphate of potassa left after the preparation of nitric acid from saltpetre.

SAL PRUNELLE. Fused nitrate of potassa cast into molds or in cakes.

SAL ROCHELLE. Rochelle salt.

SAL SEIGNETTE. Rochelle salt.

SAL SODA. (See Carbonate of Soda.)

SAL VOLATILE. Volatile salt.

SALICIN. A crystalline principle obtained from willow bark.

SALICON. Carbolic acid.

SALICYL. A compound radical containing carbon, hydrogen and oxygen.

SALICYLIC ACID. An acid obtained from phenol, having the formula $C_7H_5O_3$.

SALICYLOUS ACID. A volatile, oily liquid, obtained by distilling salicin with bichromate of potassa and sulphuric acid.

SALIFIABLE. Capable of combining with an acid to form a salt.

SALIFY. To form into a salt, as a base.

SALINE. Consisting of or containing salt.

SALIVA. The spittle.

SALIVARY. Pertaining to the saliva.

SALIVATION. A continuous, unnatural flow of the saliva.

SALOGEN. A substance which forms a haloid salt with a metal.

SALT. Chemically, a combination of an acid with a base, producing a compound different from either constituent. (See Chemistry of the Human Body.) Popularly the word salt refers to common salt, or chloride of sodium, a substance largely contain-

ed in sea-water, and also found in the earth as a mineral.

SALT ON CORPSES. In Northumberland, England, it was customary to place salt in a saucer upon the dead.

SALT OF LEMONS. Bincoxalate of potassa.

SALT OF SORREL. (See Poisons.)

SALT OF TARTAR. A name applied to the pure forms of carbonate of potassa.

SALTPETRE. (See Nitrate of Potassa and Antiseptics.)

SALUBRIOUS. Favorable to health.

SANATIVE. Curative.

SAND. (See Antiseptics.)

SAND BATH. A mode of applying heat by interposing sand between the fire and the vessel.

SANGUIFICATION. Conversion of chyle into blood.

SANGUIFLUXARS. (L.) Hemorrhage.

SANGUINEOUS. Bloody.

SANGUIS. (L.) Blood.

SANGUIS DRACONIS. (L.) (See Dragon's blood.)

SAPHENA. A vein of the leg.

SAPID. Possessing taste.

SAPIDITY. Savor.

SAPO. (Soap.) A compound of one or more of the fatty acids with alkalis or oxides; Castile soap is a hard, mottled soap made of olive oil and soda; insoluble soap is an insoluble compound of a metallic oxide with a fatty substance, not possessing detergent qualities; soft soap is a viscid semi-fluid potash soap, having an excess of alkali; hard soap is made with olive oil and soda, or from tallow and caustic soda.

SAPONACEOUS. Resembling soap.

SAPONIFICATION. Turning into soap.

SARCOCELE. Cancer of the testicle.

SARCOLACTIC ACID. One of the constituents of ox-bile.

SARCOLEMMMA. The sheath which surrounds the fibrils of muscle that make a fiber.

SARCOPHAGUS. A stone coffin, originally made from a kind of limestone which consumed the flesh within a few weeks, hence the name sarcophagus, or "flesh-eater."

SARCOSINE. (Methyl-glycocol.) A substance obtained from creatin by the action of barium hydrate. It is very soluble, and crystallizes in colorless prisms.

SARCOSIS. A fleshy tumor.

SARKOSINA. (See Sarcosine.)

SARTORIUS. (L.) The "tailor's muscle" of the thigh, by which the legs are crossed.

SATIETY. Fullness accompanied with distaste for food.

SATURATE. To cause to become completely penetrated or impregnated. To infuse into until no more can be received.

SATURATION. The combination of bodies in such proportions as to completely satisfy their combining affinities.

SATURN. Alchemic name for the metal lead.

SATURNINE. Caused by or containing lead.

SATURNISMUS. Lead-poisoning.

SATYRIASIS. Morbid sexual desire in men.

SB. Symbol for antimony. (*Stibium*.)

SCAB. A hard covering of ulcers.

SCABIES. (L.) The itch.

SCALD HEAD. An eruption of the scalp.

SCALP. The integuments of the skull.

SCALPEL. A surgeon's small knife.

SCAPHIA. (L.) The cavity of the external ear.

SCAPULA. The shoulder-blade.

SCAPULAR. Pertaining to the scapula.

SCARF SKIN. The cuticle, or epidermis.

SCARIFICATION. The making of light incisions.

SCARIFICATOR. An instrument for making light incisions.

SCARLATINA. The scarlet fever.

SCHIEDAM. Holland gin, named from the place of manufacture.

SCHIZOMYCETES. Bacteria with independent power of motion toward light and air.

SCHNAPPS. Holland gin.

SCIATIC. Pertaining to the lower bone of the pelvis.

SCIATICA. Neuralgia of the sciatic nerve.

SCINTILLATION. The bright appearance of sparks.

SCIRRHOUS. Pertaining to scirrhus.

SCIRRHUS. A hard tumor.

SCLEROTIC. Hard; tough.

SCLEROTIC COAT OF THE EYE. The hard, fibrous membrane of the eye, which, with the cornea forms the external coat; sometimes called the "white of the eye."

SCLEROTITIS. Inflammation of the sclerotic coat.

SCOLIOSIS. Rickets.

SCORBUTIC. Pertaining to, or affected with scurvy.

SCORBUTUS. (L.) The scurvy.

SCROFULA. "The king's evil;" a disease characterized by chronic swelling of the lymphatic glands.

SCROTAL. Pertaining to the scrotum.

SCROTUM. The bag containing the testicles.

SCROTOCELE. Hernia in the scrotum.

SCRUPLE. Twenty grains; the third part of a drachm.

SCUTIFORM. Shaped like a shield.

SE. Symbol for selenium.

SEARCHING. Sounding the bladder.

SEAR CLOTH. (See Cere Cloth.)

SEA SALT. (See Chloride of Sodium.)

SEBACEOUS. Suet-like.

SEBACIC ACID. An acid obtained from fat.

SEBATE. A compound of sebatic acid with a base.

SECERNENT. Secretory.

SECONDARY. A term applied to

symptoms indirectly caused by the diseases with which they are associated.

SECUNDUM ARTEM. (L.) According to the rules of art; scientifically.

SEDATIVE. Allaying excitement or irritability.

SEDIMENT. A solid deposit from a fluid.

SEDLITZ POWDERS. A combination of Rochelle salts and super-carbonate of soda with tartaric acid.

SEIGNETTE'S SALT. Rochelle salt.

SERIASIS. Sunstroke.

SEL DE BOUTIGNY. (F.) (See Calomel Iodides.)

SELENIATE. A salt formed by the combination of selenic acid with some base.

SELENIDE. A compound of selenium with a metal, or some other body which may take the place of a metal.

SELENITE. A compound of selenious acid with a base.

SELENIUM. A rare, non-metallic element resembling sulphur.

SELENIURET. A compound of selenium with some other element.

SELENIURETTED. Impregnated with selenium.

SEMEN. (L.) Seed.

SEMI. A prefix, signifying *half*.

SEMI FLUID. } Half, or imper-

SEMI LIQUID. } feetly fluid.

SEMI MEMBRANOSUS. A muscle of the thigh.

SEMINAL. Belonging to seed.

SEMINIFEROUS. (L.) A term applied to the vessels which secrete and convey the seminal fluid.

SEMI-NORMAL SOLUTION. One containing half a molecular weight in grammes dissolved in one litre of water.

SEMIVITRIFIED. Half, or imperfectly vitrified.

SENECA OIL. Petroleum from Seneca Lake, N. Y.

SENSATION. Cognizance of an impression.

SENSITIVE. Readily effected or changed by certain agents.

SENSORIUM. The center of sensation; the brain, and the collection of ganglia at its base.

SEPSIN. A poisonous proximate principle isolated from puerpeal peritoneal fluids by Panum.

SEPTIC. Pertaining to putrefaction.

SEPTUM. A partition or division.

SERALBUMEN. The albumen of the blood. (See page 178.)

SERICUM. (L.) Silk.

SEROFIBROUS. Serous and fibrous.

SEROUS. Watery; thin.

SEROUS MEMBRANE. (See Membrane.)

SERRATED. Saw-like.

SERUM. The liquid portion of the blood, after the separation of the coagulum or clot, of which albumen is the principal organic ingredient. (See page 192.)

SESQUI. A prefix, denoting the proportion of one and a half equivalents of the substance to the name of which it is prefixed, to one equivalent of some other substance.

SESQUICARBONATE OF AMMONIA. Carbonate of ammonia containing three equivalents of carbonic acid, two of ammonia, and two of water.

SESQUICARBONATE OF SODA. (*Trona*.) The native Egyptian soda.

SESQUICHLORIDE OF IRON. (See Chloride of Iron.)

SESQUIODIDE. A compound of iodine with another element in the proportion of three to two.

SESQUIOXIDE. A compound of oxygen with some other element, in the proportion of three to two.

SESQUISALT. A salt having three equivalents of one substance and two of another.

SESQUISULPHIDE. } A compound
SESQUISULPHURET. } of sulphur
with some other element, in the proportion of three to two.

SETA. (L.) A bristle; a hair.

SETACEOUS. Like bristles.

SETON. A small, artificial passage made under the skin by means of a needle carrying threads, which are daily moved in order to keep up irritation and discharge.

SEVUM. (L.) (Mutton suet.) The fat of the sheep taken from about the kidneys.

SEWAGE. The materials collected in and discharged by sewers.

SEXUAL. Pertaining to the sexes.

SHELLAC. } Resin lac spread
SHELL LAC. } into thin sheets after melting and straining.

SHERRY. A strong, alcoholic wine made from a mixture of purple and white grapes, in the vicinity of Xeres, Spain. It does not attain its best quality until fifteen years of age.

SI. Symbol of silicon.

SIALAGOGUE. A medicine increasing the secretion of saliva

SIALISMA. Salivation.

SIALON. (G.) Saliva.

SIBILANT. Having a hissing sound.

SICCATION. Drying.

SICCATIVE. A medicine prompting the process of drying.

SIGILLUM. (L.) A seal.

SIGMOID. Shaped like the Greek letter sigma; a term applied to the valve of the aorta.

SILEX. Silicic acid in an impure state, as found in flint and sand.

SILICA. Pure silicic acid.

SILICATE. A compound of silicic acid with a base.

SILICATE OF POTASSA. (Soluble Glass.) A salt prepared in a manner similar to that for obtaining silicate of soda.

SILICATE OF SODA. (Soluble Glass.) A salt obtained by fusing one part of silica, and two of carbonate of soda in an earthenware crucible. (See Antiseptics.)

SILICIC ACID. } The oxide of
SILICIUM. } silicon, found pure in the form of white, transparent quartz. Symbol, SiO_2 .

SILICON. Next to oxygen, the

most abundant of the elements. It does not occur free in nature, but always combined with oxygen. (See page 111.)

SILICO-PROPIONIC ACID. A compound in which a large percentage of the carbon of propionic acid is replaced by silicon.

SILK COLLODION. A collodion prepared by dissolving silk in a solution of chloride of zinc.

SILVER. (*Argentum.*) One of the metallic elements. (See page 111.)

SIMPLE. Elementary; that cannot be decomposed into more elementary substances.

SINAPIS. (L.) Mustard.

SINCIPUT. The fore part of the head.

SIN EATERS. In Wales a custom was prevalent at funerals, of having "sin eaters" present, who ate a piece of bread, and at the same time were supposed to assume the sins of the corpse.

SINE QUA NON. (L.) "Without which, not." An indispensable condition.

SINEW. A tendon.

SINISTER. Upon the left side.

SINUS. (L.) A long, narrow cavity.

SIPHON. A bent tube, with arms of unequal length, by which the pressure of the air is made to force liquid from one vessel to another.

SIRUP. The sweet juice of vegetables or fruits, or sugar boiled with vegetable infusions.

SITIS. (L.) Thirst.

SITON. (G.) Food.

SKELETON. The bones of an animal body.

SLAKED LIME. (See *Calcis Hydras.*)

SLAVERING. Involuntary flow of saliva.

SMALL POX. Variola; a very contagious disease, characterized by an eruption of pustules.

SN. Symbol for tin. (*Stannum.*)

SOAP. (See *Sapo*.)

SODA. The oxide of sodium.

SODA ASH. Carbonate of Sodium.

SODA BIBORATE. } (See Borax.)

SODA BORATE. } (See Borax.)

SODÆ BICARBONAS. (L.) (See Bicarbonate of Soda.)

SODÆ BORAS. (See Borax.)

SODÆ CARBONAS. (See Carbonate of Soda.)

SODÆ CHLORATÆ LIQUOR. (See Chloride of Soda Solution.)

SODÆ HYPOSULPHIS. (Hydrosulphite of Soda.) A salt prepared by digesting sulphite of soda with sulphur. It is said to be destructive of microscopic fungi.

SODÆ MURIAS. Chloride of Sodium.

SODÆ NITRAS. (See Cubic Nitrate.)

SODÆ SILICAS. (See Silicate of Soda.)

SODA HYDRATE. (See Caustic Soda.)

SODA MURIATE. (See Chloride of Sodium.)

SODA NITRATE. (See Cubic Nitrate.)

SODA SOLUTION, CHLORINATED. (See Antiseptics.)

SODA SULPHATE. (See Glauber's Salt.)

SODA SULPHITE. A salt prepared by passing sulphurous acid into a solution of carbonate of soda. (See Antiseptics.)

SODA VITRIOLATED. (See Glauber's Salt.)

SODA GLYCOCHOLATE. A salt of glycocholic acid existing in the bile, crystallizing in stellate needles.

SODIC URATE. A salt obtained by saturating a solution of caustic soda with uric acid.

SODII CHLORIDUM. (L.) (See Chloride of Sodium.)

SODIUM. One of the metals. (See page 111.)

SOFT WATER. A pure water which forms a lather with soap.

SOLAR PLEXUS. An assemblage of ganglia connected with the great sympathetic nerve.

SOLEUS. A muscle of the leg.

SOLUBLE. That can be dissolved.

SOLUBLE GLASS. (See Silicate of Soda.)

SOLUTION. The state of being dissolved; a substance dissolved in a liquid.

SOLUTIONS. (See Liquor.)

SOLUTIVE. Laxative.

SOLVENT. A liquid capable of dissolving bodies.

SOMNAMBULISM. Sleep-walking.

SOMNIFEROUS. Bringing sleep.

SOMNOLENCY. Sleepiness.

SOOT. (*Fuligo Ligni*.) A substance produced by burning wood; it contains creasote, chloride of potassium, sulphate of potassium, etc.

SOPORIFIC. Inducing deep sleep.

SORBEFACIENT. Absorbent.

SOUND. A metallic instrument for exploring the bladder.

SOUNDING. Exploring the bladder.

SPA. A mineral spring.

SPASM. Morbid contraction of muscles.

SPATULA. A thin flat knife for spreading ointments, etc.

SPECIFIC. A term applied to remedies which act on any part of the system, and produce uniform results.

SPECIFIC GRAVITY. The density of bodies compared with an equal bulk of water. (See page 134.)

SPECIFIC GRAVITY BOTTLE. A bottle, having a capacity for exactly 1000 grains of distilled water, when filled with any liquid whose specific gravity is to be ascertained, and weighed gives the weight in grains of the liquid, also its specific gravity.

SPECTROSCOPE. An instrument for observing the elongated image formed by the passage of luminous rays through a prism. By its use five new elements have been discovered.

ered, and the composition of the heavenly bodies determined.

SPELTER. Commercial zinc.

SPERM. The seminal fluid.

SPERMACETI. (See Cetaceum.)

SPERMATIC. Belonging to the testacles and ovary.

SPERMATORRHOEA. Seminal flux.

SPERMATOOA. Thread-like, minute bodies discovered in the semen, constituting its fecundating principle.

SPHENOID. Wedge-shaped. Name of a bone at the base of the skull.

SPHENOIDAL. Belonging to the sphenoid bone.

SPHERO-BACTERIA. Minute, spherical or oval cells, appearing singly or adhering to one another in pairs or chains. The micrococcus is the only genus of this group.

SPHEROID. Nearly spherical.

SPHINCTER. A muscle surrounding an opening of the body, closing it by its contraction.

SPHYGMOS. (G.) The pulse.

SPHYGMOGRAPH. An instrument devised to record the form and force of the movements of the arterial pulse.

SPICE. A fragrant or aromatic vegetable production.

SPICULA. A little spike; a pointed piece of bone.

SPINA. (L.) A thorn; the backbone.

SPINAL. Pertaining to the backbone.

SPINE. The vertebral column; the backbone.

SPINOUS. Thorny.

SPIRILLA. Corkscrew-like, spirally moving microbes.

SPIRIT. A volatile fluid; the product of distillation.

SPIRIT OF CAMPHOR. (Tincture of Camphor.) A solution of four ounces of camphor in two pints of alcohol.

SPIRIT OF MALT. A spirit distilled from malt which is the basis of most of the spirituous cordials.

SPIRIT OF TURPENTINE. A common name for oil of turpentine.

SPIRIT OF WINE. Alcohol.

SPIRIT, PROOF. (See Proof Spirit.)

SPIRIT, PYROACETIC. (See Acetone.)

SPIRIT, PYROXYLIC. (See Alcohol, Methyl.)

SPIRIT, RECTIFIED. (See Alcohol.)

SPIRITUS. (L.) (See Spirit.)

SPIRITUS FRUMENTI. (L.) (Whisky.) Spirit obtained by the distillation of fermented grain, containing from 48 to 56 per cent of alcohol.

SPIRITUS PYROXYLICUS RECTIFICATUS. (See Alcohol, Methyl.)

SPIRITUS RECTIFICATUS. (See Alcohol.)

SPIRITUS VINI GALICI. (See Brandy.)

SPIROBACTERIA. Cylindrical cells, generally several lines longer than wide, and spirally twisted like a corkscrew.

SPIROCHAETE. A variety of spirobacteria.

SPIROL. Carbolic acid.

SPIROMETER. An instrument for measuring the capacity of the lungs.

SPIROUS ACID. (See Salicylous Acid.)

SPISSITUDE. The thickness of soft substances.

SPLANCHNA. (G.) The entrails.

SPLANCHNIC. Pertaining to the viscera.

SPLANCHNOLOGY. Description of the entrails.

SPLEEN. An organ in the left hypochondrium. (See page 77.)

SPLINTS. Long flat pieces of wood, used in securing fractured bones, etc.

SPONGE. (*Spongia*.) An animal, inhabiting the bottom of the sea, of which there are many species. They produce the porous substance called sponge, and are most abundant in the tropics.

SPORADIC. Confined to some particular locality.

SPORES. Reproductive bodies analogous to seeds or germs.

SPRAIN. The sudden shifting of a joint farther than the natural conformation of bones and ligaments allow.

SPUMA. (L.) Froth.

SPURGE. The common name for a number of species of *Euphorbia*.

SPURIOUS. False.

SQUAMA. (L.) A scale.

SQUAMOUS. Scaly.

SR. Symbol for strontium.

STAMINA. Strength.

STANDARD. Having a fixed or permanent value. *Standard solutions* are solutions of chemical reagents of known strength used in chemical analysis.

STANNIC ACID. An acid prepared by decomposing bichloride of tin with water.

STANNUM. (L.) Tin.

STAPES. (L.) A small bone of the internal ear.

STARCH. A vegetable product. (See *Amylum*.)

STASIS. Stagnation of the blood.

STEAM. The vapor of water.

STEARATE. A compound of stearic acid with some base.

STEARIC ACID. An acid obtained from fats and bile. (See page 263.)

STEARIN. (See page 163.)

STEAROPTENE. The solid portion of volatile oils.

STEARONE. A substance obtained from the partial decomposition of stearic acid with a fourth part of quicklime.

STEATOMA. A species of fatty tumor.

STEEL. A compound of iron and carbon.

STERCORACEOUS. A term applied to vomiting when feces is mingled with other matters thrown out.

STERILITY. Barrenness.

STERILIZED FLUIDS. Fluids deprived of all germs of bacterial life.

STERNAL. Pertaining to the sternum.

STERNALGIA. Pain in the sternum.

STERNUM. The breast-bone. (See page 61.)

STERNUTATORY. Causing to sneeze.

STERTOR. (L.) Noisy respiration.

STETHOS. (G.) The breast.

STETHOSCOPE. An instrument applied to the breast for listening to the sound of the lungs.

STHENIC. Possessed of strength.

STIBIUM. The ancient name for antimony.

STILL. A vessel used in distilling fluids.

STITCH. A spasmodic pain.

STIMULANT. An exciting agent.

STIMULUS. That which incites to action.

STOICHIOMETRY. The doctrine of chemical equivalents. (See page 119.)

STOMA. (G. Plural, *Stomata*.) A mouth; a breathing-pore.

STOMACH. (See page 76.)

STOMACH PUMP. A small pump with a flexible tube, for drawing liquids from the stomach.

STOMACH TEETH. The canine teeth of the lower jaw.

STOMATITIS. Inflammation of the mouth.

STOOLS. The feces or passages from the bowels.

STOUPE. A cloth soaked in turpentine, etc., used in fomentations.

STOVED SALT. A variety of salt so named in commerce.

STRABISMUS. Turning of the eyes from their proper direction; squinting.

STRANGULATION. A stricture; a choking.

STRANGURY. A painful discharge of urine.

STRASBURG TURPENTINE. The product of the *Abies pectinata* or European silver fir. (See Antiseptics.)

STREPTO-COCOCCUS. A bacterium in which the segments are united in a long chain.

STRIATE. Marked with long lines.

STRICTURE. Contraction or closing of a passage.

STRONGER ALCOHOL. Alcohol having the specific gravity 0.817.

STRONTIA. The oxide of strontium; an alkaline earth.

STRONTIUM. A yellowish-white metal.

STRUMOUS. Scrofulous.

STUPOR. Drowsiness.

STYLIFORM. Shaped like a narrow rod.

STYLOID. A process of the temporal bone.

STYPTIC. A medicine which serves to arrest bleeding.

STYPTIC COLLOID. A liquid consisting of ether saturated with tannic acid or some such substance as gun-cotton.

STYRAX. (*Storax*.) A balsamic juice obtained from the Oriental Sweet Gum.

STYRAX BENZOIN. (See *Benzoin*.)

STYROL. The essential oil of styrax.

STYROLINE. A constituent of coal tar.

SUB. A prefix denoting a low degree of a quality.

SUBACETATE. An acetate having an excess of base.

SUBACID. Moderately acid.

SUBCARBONATE. A carbonate containing more than one equivalent of the base for each equivalent of carbonic acid.

SUBCARBURETTED. Having more equivalents of base than of carbon.

SUBCHLORIDE OF MERCURY. (See *Calomel*.)

SUBCLAVIAN. Lying beneath the clavicle.

SUBCUTANEOUS. Beneath the skin.

SUBERATE. A compound of suberic acid with some base.

SUBIODIDE. A subsalt containing less iodine than the iodide.

SUBLIMATE. To bring by heat into the state of vapor, which, on cooling, returns to the solid state; the product of such a process.

SUBLIMATE, CORROSIVE. (See *Corrosive Sublimate*.)

SUBLIMATED SULPHUR. (Flowers of Sulphur.) Sulphur prepared from a crude state by sublimation.

SUBLINGUAL. Situated beneath the tongue.

SUBMAXILLARY. Under the lower jaw.

SUBMERISION. Sinking below the surface of a liquid.

SUBSALT. A salt containing a less number of equivalents of the acid than the base.

SUBSTERNAL. Beneath the breast-bone.

SUBSULPHATE. A sulphate with an excess of the base.

SUBSULPHIDE. A sulphide having an excess of some other substance, as a metal.

SUCCESSION. A following of things in order of time or place.

SUCCINATE. A compound of succinic acid with a base.

SUCCINIC ACID. An acid obtained from amber.

SUCCULENT. Juicy.

SUCUS. (L.) Juice.

SUDOR. (L.) Sweat.

SUDORIFIC. Inducing perspiration.

SUGAR. A sweet vegetable product.

SUGAR OF GELATIN. (See *Glycoll*.)

SUGAR OF MILK. A hard, crystalline, white substance, obtained by evaporating the whey of milk.

SUGAR OF MUSCLE. (See *Inosite*.)

SULPHATE. A compound of sulphuric acid with some base.

SULPHATE OF COPPER. (See *Cupri Sulphas* and *Antiseptics*.)

SULPHATE OF IRON. (See *Ferri Sulphas* and *Antiseptics*.)

SULPHATE OF LIME. (See *Calcis Sulphas* and Antiseptics.)

SULPHATE OF POTASSA. (See *Potasse Sulphas*.)

SULPHATE OF SODA. (See *Glauber's Salt*.)

SULPHATE OF ZINC. A salt obtained by dissolving zinc in sulphuric acid. It is also called "white vitriol." Formula, ZnSO_4 . (See Antiseptics.)

SULPHIDE. A compound of sulphur with another element or some substance taking the place of an element.

SULPHIDE OF AMMONIA. A substance occurring in colorless crystals, obtained by bringing together sulphuretted hydrogen and ammonia gas.

SULPHIDE OF CARBON. (See *Bisulphide of Carbon*.)

SULPHITE. A salt formed by the combination of sulphurous acid with a base.

SULPHITE OF SODA. (See *Soda Sulphite*.)

SULPHO-ACIDS. Conjugate acids formed when strong sulphuric acid is added to many organic compounds.

SULPHO-ACETIC ACID. An acid obtained by heating together chloride of acetyl, sulphate of silver, and powdered glass.

SULPHOCARBOLATE OF SODA. A salt prepared by adding carbonate of soda to a heated mixture of carbolic and sulphuric acids.

SULPHOCARBOLATE OF ZINC. A salt obtained by adding zinc to a compound of sulphuric and carbolic acids.

SULPHOCARBOLIC ACID. An acid in needle-shaped crystals.

SULPHOCARBONIC. Consisting of sulphur and carbon.

SULPHOCYANIDE. A compound of sulphocyanogen and another constituent.

SULPHOPHENATES. (Sulphocarbulates.) A class of salts obtained by treating carbolic acid with sulphuric acid at a high temperature. They

have many of the properties of crude carbolic acid, but not its strong odor.

SULPHO SALTS. A term applied to compounds formed by the combination of different sulphurets.

SULPHOVINIC ACID. (Ether Sulphuric acid.) An acid formed by the mixture of two equivalents of sulphuric acid, and one of alcohol.

SULPHUR. (See page 112.)

SULPHURET. A compound of sulphur with another element, or some substance taking the place of an element.

SULPHURETTED HYDROGEN. (See *Hydrosulphuric Acid*.)

SULPHURIC ACID. (Oil of Vitriol.) The most important and useful acid known. It is a thick, oily liquid, boiling at 338° , and freezing at 10.5 . Formula, H_2SO_4 .

SULPHUROUS ACID. (See *Acids*.)

SULPHYDRIC. Containing sulphur and hydrogen.

SUNSTROKE. An affection produced by the action of the sun upon some part of the body. Especially a sudden prostration of the physical powers, with symptoms resembling those of apoplexy, occasioned by exposure to excessive heat.

SUPER. A prefix denoting an excess of some element.

SUPERACIDULATED. Acidulated to excess.

SUPERCILIA. (L.) The eyebrows.

SUPERFICIAL. Near the surface.

SUPERIOR. Higher.

SUPERNATANT. Floating above.

SUPEROXIDE. An oxide containing more oxygen than base.

SUPERPHOSPHATE. A phosphate containing the greatest amount of phosphoric acid that can combine with a base.

SUPERPHOSPHATE OF LIME. A soluble salt, containing phosphoric acid and calcium.

SUPERSALT. A salt containing more equivalents of acid than of base.

SUPERSATURATE. To add to beyond saturation.

SUPERSULPHATE. A sulphate containing more acid than base.

SUPERSULPHURETTED. Containing more equivalents of sulphur than of base with which the sulphur is combined.

SUPINE. Lying on the back.

SUPPURATION. Production of pus.

SUPRA. (L.) Above.

SUPRARENAL CAPSULE. A flat triangular body, which covers the upper part of the kidney as with a helmet.

SUSPENSORY. That which suspends.

SUSURRUS. (L.) A low murmuring.

SUTTEE. The custom formerly prevalent in India, of cremating a widow upon the pyre of her deceased husband.

SUTURE. A joining.

SWEET PRINCIPLE OF OILS. (See Glycerine.)

SYMBOL. A sign or representation. (See page 117.)

SYMPATHETIC. Associated together in function.

SYMPHYSIS. A connection of bones by intervening texture.

SYMPTOM. A sign of disease.

SYNCHRONOUS. Occurring in equal time.

SYNCOPE. Swooning.

SYNDESMOSIS. Connection of bones by ligaments.

SYNOVIA. A fluid lubricating the joints.

SYNTHESIS. The uniting of elements to form a compound.

SYNTONIN. A protein compound contained in the fibrils of muscles.

SYPHILIS. Venereal disease.

SYRINGE. An instrument for ejecting fluids.

SYRUP. (See Sirup.)

SYSTEM. A term applied to the human body; also to an assemblage of similar parts composed of an identical tissue.

SYSTEMIC. Pertaining to the whole system.

T.

TABES. (L.) Wasting of the body.

TAG ALDER. (*Alnus incana.*) A plant common in this country, whose bark is used to arrest a flow of blood.

TÆNIA. (L.) Tape-worm.

TALC. A soft magnesian mineral, soapy to the touch.

TALIPES. (L.) Club-foot.

TALLOW. The suet or fat of animals separated by melting from foreign substances.

TAMPON. (F.) A plug introduced into a cavity of the body.

TANACETUM. (Tansy.) (See Poisons.)

TANNATE. A compound of tannic acid and a base.

TANNIC ACID. (See Tannin.)

TANNIC ACID. A name given to quite a number of different substances of vegetable origin, principally derived from barks, leaves, and seeds. They are amorphous; soluble in water, astringent, and capable of forming imputrescible compounds with the gelatinoids.

TANNING. The conversion of skin into leather. This was one of the modes adopted by the Egyptians for the preservation of their dead.

TAPPING. Puncturing a dropsical cavity with a hollow needle, for the purpose of drawing off the water.

TARICHEUTES. The embalmers proper of Egypt.

TARSUS. (L.) The instep or ankle.

TARTAR. A deposit from wine, consisting of potassa united with an excess of tartaric acid. Also an earth-like substance deposited from the saliva, which becomes incrustated on the human teeth.

TARTAR, CREAM OF. Bitartrate of Potash.

TARTAR EMETIC. (See *Antimonii et Potassæ Tartras*.)

TARTARUS BORAXATUS. A salt prepared by dissolving boracic acid and cream of tartar in water and evaporating to dryness.

TARTARIC ACID. (See Acids.)

TARTARIZED ANTIMONY. (See *Antimonii et Potassæ Tartras*.)

TARTARUM VITRIOLATUM. (Sulphate of Potassa.) A salt produced in the distillation of nitric acid from nitre and sulphuric acid.

TARTRAS BORICO-POTASSICUS. (See *Tartras Boraxatus*.)

TARTRATE. A compound of tartaric acid with a base.

TARTRATE OF ANTIMONY AND POTASSA. Tartarized antimony.

TARTROVINIC. Pertaining to a certain acid composed of tartaric acid in combination with the elements of ether.

TAR-WATER. An infusion of tar.

TAURIN. (See page 201.)

TAUROCHOLIC ACID. (See page 201.)

TAXIS. A replacing of parts in their natural situation by the hand.

TE. Symbol for tellurium.

TEAR-JUG. A small jug deposited in the tombs of the Romans, and supposed to contain the tears of mourners.

TEGUMENTARY. Pertaining to the covering.

TELLURATE. A compound of telluric acid with a base.

TELLURET, } A non-acid com-
TELLURIDE. } pound of tellu-
rium with another element.

TELLURIC ACID. An acid having the formula, $H_4 Te O_4$.

TELLURITE. A compound of tellurous acid with a base.

TELLURIUM. A rare white element resembling sulphur in many of its properties.

TEMPERAMENT. Constitutional peculiarity.

TEMPORA. (L.) The temples.

TEMPORAL. Pertaining to the temples.

TENACULUM. (L.) A hook used by surgeons in securing arteries.

TENDON. A white elongated extremity of a muscle.

TENDO ACHILLIS. (See Achilles Tendon.)

TENESMUS. Pain and difficulty in defecation.

TENOTOMY. The dividing of a tendon.

TENSE. Stretched; tight.

TENSOR. Name of certain muscles whose office is to extend the part to which they are attached.

TEPID. Slightly warm.

TERCHLORIDE. A chloride containing three equivalents of chlorine.

TERCHLORIDE OF ANTIMONY SOLUTION. (See Poisons.)

TERCHLORIDE OF FORMYL. (See Chloroform.)

TEREBINTHINA. (Turpentine.) The concrete juice of several species of the pine tree

TEREBINTHINA VULGARIS. Common European turpentine.

TEREBINTHINÆ OLEUM. (See Oil of Turpentine.)

TERES. (L.) Round; cylindrical.

TERGUM. (L.) The back.

TERIODIDE. An iodide containing three equivalents of iodine.

TERIODIDE OF FORMYL. (See Iodoform.)

TERNARY. Relating to the number three. (See page 127.)

TERNATE. Having an arrangement by threes.

TERNITRATE. A nitrate containing three equivalents of nitric acid.

TEROLEATE OF GLYCERYL. (Triolein.) A name given by Berthelot to a compound formed by the combination of carbon, hydrogen and oxygen; olein.

TEROXIDE OF ANTIMONY. (See Poisons.)

TERPIN. A crystalline, hydrated oil of turpentine.

TERRA ALBA. (L. White Earth.) A substance prepared from sulphate of lime, used for adulteration of confectionery, etc.

TERRENUS. (L.) Belonging to the earth.

TERSULPHATE. A sulphate containing three equivalents of sulphuric acid.

TERSULPHURET. A sulphuret containing three equivalents of sulphur.

TERTIAN. Recurring every third day.

TEST. A substance used to detect any unknown constituent of a compound, by causing it to exhibit some characteristic property; a reagent.

TESTA. (L.) A shell.

TESTACEOUS. Of the nature of shell.

TESTES. (L.) Plural of Testis, which see.

TESTIS. The gland in the scrotum which secretes the semen.

TEST-PAPER. Paper impregnated with some reagent, such as litmus, and used for detecting the presence of any substance.

TEST-TUBE. A tube for holding substances to be tested.

TETANUS. A disease in which there is a spasmodic contraction of the muscles of voluntary motion, with tension and rigidity of the parts affected.

TETRA. } A prefix denoting the
TETRAD. } number four.

TETRACHLORIDE. A chloride containing four equivalents of chlorine.

TETRACHLORIDE OF CARBON. (See Bichloride of Carbon.)

TETRATHIONATE OF SODA. A salt formed by the solution of iodine in the hyposulphite of soda.

TETTER. A vesicular disease; herpes.

TEXTURE. Tissue; membrane.

TH. Symbol for thorium, or thorinum.

THALLIC ACID. An acid formed when oxide of thallium is suspended in potash lye, and a stream of chlorine gas is passed through it.

THALLIUM. A soft bluish-white metal resembling lead in its physical properties.

THALMUS. A part of the brain.

THECA. (G.) A sheath.

THEOBROMÆ OLEUM. (L.) Oil of theobroma. (See Butter of Cacao.)

THERAPEUTICS. Knowledge relating to the curative action of medicines.

THERIACA. (Venice Treacle.) An alleged antidote to poisons, composed of a great number of drugs pulverized and mingled with honey.

THERMOMETER. An instrument for measuring heat. (See Freezing Point.)

THESIS. A dissertation on a certain subject.

THIEVES' VINEGAR. (See Mar-seilles Vinegar.)

THIONESSAL. A sulphur obtained from petroleum.

THORACIC. Pertaining to the chest.

THORAX. The chest. (See page 62.)

THORINUM. } A heavy, gray metal
THORIUM. } which burns with great brilliancy.

THROMBUS. A coagulum of blood forming in the veins.

THYME. A pungent aromatic plant possessing a volatile oil which may be separated by distillation.

THYMENE. A hydrocarbon contained in the oil of thyme.

THYMIC ACID. } A concrete prin-
THYMOL. } ciple obtained from the oil of thyme by submitting it to cold. (See Antiseptics.)

THYMUS GLAND. A gland behind the sternum.

TIBIA. The large bone of the lower leg.

TIBIAL. Pertaining to the tibia.

TIC DOULOUREUX. (F.) Neuralgia of the facial nerve.

TIGLII OLEUM. (See Croton Oil.)

TIN. (*Stannum.*) A white, soft, malleable, ductile metal which occurs as tin dioxide in various places, principally in Cornwall.

TINCAL. Crude borax.

TINCTURE. (*Tinctura.*) A solution of medicinal substances in alcohol.

TINDER. (*Agaric.*) A fungus used for kindling fire.

TINNITUS AURIUM. (L.) A ringing sound in the ears.

TISSUE. By this term in anatomy, is meant the various parts, which, by their union, form the organs, and are, as it were, their anatomical elements. (See Membranes.)

TITANATE. A compound of titanic acid with some base.

TITANIC. Pertaining to titanium.

TITANIUM. A blue metal, discovered in 1791.

TITHONIC. Pertaining to those rays of light which produce chemical effect.

TITRATE. To analyze by means of standard solutions.

TITRATION. Volumetric analysis.

TITUBATION. Restlessness.

TOBACCO (See Poisons.)

TOLOGY. Science of midwifery.

TOLENE. A volatile oil obtained from balsam of tolu.

TOLUDINA. An artificial alkaloid obtained from oil of turpentine.

TONE. The natural and healthy tension of muscular fibers.

TONKA BEAN. An aromatic bean obtained from the *Coumarouna odorata*, a tree growing in Guiana.

TONSILS. Glands on each side of the throat.

TONSILITIS. Inflammation of the tonsils.

TOPICAL. Local.

TORPOR. Dullness; inactivity.

TORICELLIAN VACUUM. The vacuum at the upper part of the barometer.

TORREFY. To dry or parch until in a friable state.

TORISON. Twisting.

TORULA. Micrococci grouped together like a necklace.

TORULACEOUS. Of the nature of torula.

TOURNIQUET (F.) A surgical instrument, which is tightened or relaxed with a screw, and used to check the flow of blood.

TOW. The coarse and broken part of flax and hemp.

TOXIC. Poisonous.

TOXICOLOGY. The science which treats of poisons and their antidotes.

TRACHEA. The windpipe.

TRACHEAL. Pertaining to the windpipe.

TRACHITIS. Inflammation of the mucous membrane of the trachea.

TRACHEOTOMY. Incision into the windpipe.

TRACTION. Steady pulling.

TRAGACANTH. A somewhat insoluble gum, obtained from the *As-tragalus versus*. Its uses are somewhat similar to gum arabic.

TRANSFUSION. Conveying the blood from one animal to the veins of another.

TRANSPIRATION. Exhalation outward.

TRANSUDATES. The products of transudation.

TRANSUDATION. The passage of blood or other fluid, unaltered, through the pores of the skin or membranes.

TRAPEZIUS. A muscle of the shoulder blade.

TRAUMATIC. Pertaining to wounds.

TREACLE. A viscid, uncrystallizable syrup, which drains from the sugar refiner's molds.

TREMOR. (L.) Trembling.

TREPAN. {

TREPHINE. { A cylindrical saw,

an instrument for perforating bones.

TRESIS. A perforation.

TRI. A prefix signifying three.

TRIBASIC. Containing three equivalents of base to one of acid.

TRICEPS. (L). Three-headed.

TRICHIASIS. Inversion of the eye-lids.

TRICHINA. An animal parasite found in the muscles of animals, and sometimes in man, producing death by its presence.

TRICUSPID. Three-pointed.

TRIFID. Three-cleft.

TRIFACIAL. A facial nerve.

TRIGASTRIC. Three-bellied.

TRIMETHYLAMIN. (See page 266.)

TRINERVIS. (L). Three-nerved.

TRINITRO CELLULOSE. Gun-cotton.

TRIOLEIN. (See Teroleate of glycerine.)

TEROXIDE. A non-acid compound of one equivalent of base with three equivalents of oxygen.

TRISMUS. Lock-jaw.

TRITURATE. To rub down in mortar.

TRITURATION. The act of rubbing down in mortar.

TROCAR. A hollow instrument used for tapping. (See page 294.)

TROCHAR. (See Trocar.)

TROCHLEA. A cartilaginous pulley through which a muscle passes.

TROCHLEARIS. A muscle of the eye.

TRONA. A native sesquicarbonate of soda.

TROY WEIGHT. The weight by which gold, silver, jewels, etc., are weighed. The troy pound contains 12 ounces, the ounce 20 pennyweights, and the pennyweight 24 grains.

TRUNK-NERVE. A main nerve giving off branches.

TRYPSIN. One of the digestive ferments of pancreatic juice.

TRYSIS. (G.) Friction.

TUBERCLE. A small swelling or tumor in the substance of an organ.

TUBEROSITY. A protuberance.

TUBULAR. Tube-like.

TUMEFACTION. Swelling.

TUMID. Swollen; distended.

TUMOR. A morbid, circumscribed enlargement.

TUNGSTATE. A compound of tungstic acid with a base.

TUNGSTEN. A grayish-white, lustrous metal, discovered in 1781.

TUNGSTIC ACID. When tungsten is heated to redness in the open air, it takes fire, and is converted to tungstic acid.

TUNIC. A coat; a membranous covering.

TURGID. Swollen.

TURPENTINE. A term applied to certain vegetable juices which consist of resin, combined with a peculiar essential oil called oil of turpentine. They are generally procured from the pine or some similar tree.

TURPENTINE, BORDEAUX. (See Bordeaux Turpentine.)

TURPENTINE, CANADA. (See *Abies Balsamea*.)

TURPENTINE, CHIAN. (See Chian Turpentine.)

TURPENTINE, COMMON AMERICAN. (See White Turpentine.)

TURPENTINE, COMMON EUROPEAN. (See *Pinus Sylvestris*.)

TURPENTINE OIL. (See Oil of Turpentine.)

TURPENTINE, STRASBURG. (See Strasburg Turpentine.)

TURPENTINE, SYRIAN. A substance which was used in making Theban mummies.

TURPENTINE, VENICE. (See Venice Turpentine.)

TURPENTINE, WHITE. (See White Turpentine.)

TURPETH MINERAL. The ortho-sulphate of mercury. (See Poisons.)

TYMPANUM. The drum of the ear.

TYPHOID. Resembling typhus; a low fever.

TYPHUS. A congestive and malignant fever.

TYPIC. Characterized by periodicity.

TYROSIN. An alkaloid found in

the liver and other parts of the body. (See page 265.)

TYROTOXICON. (See Poisons.)

U.

U. Symbol for uranium.

ULCER. A sore discharging pus, originating generally in a constitutional disorder.

ULCERATION. The formation of an ulcer.

ULCUS. (L.) An ulcer.

ULMIC ACID. A vegetable principle first discovered in the matter issuing from the bark of the European elm.

ULMIN. (See Ulmic Acid.)

ULNA. The under bone of the fore-arm.

ULNAR. Pertaining to the ulna.

ULTIMATE ANALYSIS. The resolution of a subject into its elements.

UMBILICAL. Pertaining to the navel.

UMBILICAL CORD. The navel cord uniting the child to the mother in the womb.

UMBILICUS. The navel; the depression in the center of the abdomen being the scar left by the umbilical cord. From great distension of the abdomen the umbilicus may become everted or obliterated.

UNCIFORM. Hook-like. A bone of the wrist.

UNCTION. The act of anointing or smearing with an ointment.

UNCTUOUS. Fat; oily; greasy.

UNGUENT. } (See Ointment.)

UNGUENTUM. }

UNGUIS. (L.) A nail.

UPAS. A poison tree of Java.

URÆMIA. The presence of urea in the blood.

URANIC. Pertaining to uranium.

URANIUM. A white-colored metal which occurs but sparingly in na-

ture; it does not oxidize in dry air at ordinary temperatures, but when strongly heated it burns brilliantly.

URATE. A compound of uric acid with some base.

URATE OF AMMONIA. An acid salt formed by digesting uric acid in a solution of ammonia.

URATE OF POTASH. (See page 207.)

UREA. An organic principle found in urine. (See page 206.)

URECHYSIS. The effusion of urine into the cellular tissue.

URERYTHRIN. (Urohæmatin.)

The coloring matter of human urine.

URETER. The canal between the kidney and the bladder.

URETERITIS. Inflammation of the ureter.

URETHRA. The canal from the bladder for carrying off the urine.

URETHRITIS. Inflammation of the urethra.

URETIC. (See Diurectic.)

URIC. Pertaining to urine.

URIC ACID. (Lithic Acid.) An acid occurring in small quantities in healthy human urine. (See page 204.)

URINE. The fluid secreted by the kidney. (See page 204.)

URINOMETER. An instrument for measuring the specific gravity of urine.

URODIALYSIS. A suppression of urine.

USTULATION. Roasting or drying moist substances so as to prepare them for pulverizing.

UTERINE. Pertaining to the uterus.

UTERO-GESTATION. Pregnancy.

UTERUS. The womb.

UVEA. The black pigment on the back part of the iris.

UVIC ACID. (See Paratartaric Acid.)

UVULA. The pendulous body behind the soft palate.

UVULITIS. Inflammation of the uvula.

V.

VACCINA. The cow-pox.

VACCINATION. Insertion of cow-pox virus under the skin as a preventive of small-pox.

VACCINIC ACID. A fatty acid obtained from butter.

VACUUM. Space empty of all matter; often applied to a space from which the air has been exhausted.

VAGINA. The passage to the uterus.

VALEREN. (See Amylen.)

VALERIANATE OF AMYLIC ETHER.

A preparation formed by mixing together amylic alcohol with sulphuric acid, and afterward adding valeric acid.

VALERIANIC ACID. (See page

VALERIC ACID. { 262.)

VALERINATE. A compound of valeric acid with some base.

VALERINATE OF AMMONIA. A salt formed by neutralizing valeric acid with gaseous ammonia.

VALETUDINARIAN. One in feeble health.

VALVES OF THE HEART. (See page 67.)

VANADIUM. A rare, grayish-white metal, occurring in certain ores.

VANADOUS. Pertaining to vanadium.

VAPORIZATION. Conversion into vapor.

VAPOR. An elastic fluid into which a liquid or solid is converted by heat; it differs from a gas in not being permanently elastic, but resumes the liquid or solid form on being cooled down to ordinary temperatures.

VAPOR-BATH. An apparatus for heating substances by the vapor of water.

VARICELLA. The chicken-pox.

VARICOSE. Resembling varix.

VARIOLE. The small-pox.

VARIOLOID. A mild form of

small-pox occurring after vaccination.

VARIX. Morbid dilatation of a vein, analogous to aneurism in the arteries.

VARNISH. A solution of resinous matter in a volatile fluid, the fluid part of which evaporates after application, leaving the resinous part forming a smooth, hard surface.

VARUS. A pimple on the face.

VAS. (L.) A vessel.

VAS DEFERENS. (L. "The conveying vessel.") The duct which conveys the semen from the testicle into the ejaculatory duct.

VASA. (L.) Vessels.

VASCULAR. Pertaining to, or consisting of, vessels.

VASCULAR SYSTEM. The system of vessels which include the heart, arteries, veins, capillaries, and lymphatics.

VASELINE. (Cosmoline, Petroleum Jelly.) A concentrated essence of petroleum, used as a basis of ointments and as an emollient application. It is insoluble in water and alcohol. *Carbolated Vaseline* is useful for anointing the hands before beginning the process of embalming.

VEGETABLE ALBUMEN. (See Albumen.)

VEGETABLE CHARCOAL. (See Carbon.)

VEGETABLE FIBRIN. (See Gluten.)

VEGETARIAN. One living solely upon vegetable food.

VEGETATION OF SALTS. Concretions formed by salts after solution, when set in the air for evaporation. They appear on the sides of the vessel containing the solution, and in their branching form resemble plants.

VEGETO-ANIMAL SUBSTANCES. A term applied to vegetable albumen and pure gluten, from their resemblance to proximate animal principles.

VEHICLE. Any substance with which medicine can be mixed.

VEIN. A long, membranous canal returning the blood of the heart.

VEIN, FEMORAL. The large vein of the thigh. (See plate III.)

VEINS, SAPHENOUS. Two veins of the leg. (See plate III.)

VELUM. The soft palate.

VENA. (L.) A vein.

VENA CAVA. A name given to two large veins opening into the heart. (See page 66.)

VENESECTION. The opening of a vein.

VENEREAL. Belonging to sexual intercourse.

VENOUS. Pertaining to a vein.

VENTRAL. Pertaining to the belly; abdominal.

VENTRICLES. Cavities in different organs. *Ventricles of the Brain* are five cavities in the interior of that organ. *Ventricles of the Heart* are two cavities on both its right and left sides. (See page 67.)

VENTRICULAR. Relating to small cavities.

VENULA. (L.) A small vein.

VERATRUM. (See Poisons.)

VERDIGRIS. A common name for the subacetate of copper. (See Poisons.)

VERMIS. (L.) A worm.

VERTEBRÆ. Bones of the spinal column.

VERTICAL. Perpendicular.

VERTIGO. Giddiness; dizziness.

VESICA. (L.) A bladder.

VESICAL. Pertaining to the bladder.

VESICLE. A bladder; a blister.

VESICULAR. Belonging to, or having vesicles; like a bladder.

VESSELS. Canals or conduits by which blood, chyle, etc., are conveyed through the body and organs.

VESTIBULE. The small elliptical cavity of the internal ear.

VETERINARY. Pertaining to beasts of burden.

VIBRIO. (L. Plural, Vibriones.) Eel-shaped, undulatory, mobile bacteria.

VIBRIONES. (See Vibrio.)

VIENNA CAUSTIC. A name for a combination of caustic potash and lime.

VINEGAR. (*Acetum.*) Impure acetic acid prepared by fermentation. It is derived from wine, cider, or other vegetable juices. The process seems to depend upon the presence of a species of fungus called *Mycoderma aceti*.

VINEGAR, AROMATIC. (See Select Formulæ.)

VINEGAR, DISTILLED. Vinegar separated from its impurities by distillation.

VINEGAR, PROOF. (See Proof Vinegar.)

VINEGAR, PYROLIGNEOUS. Crude pyroligneous acid.

VINOUS. Having the qualities of wine.

VINOUS FERMENTATION. (See Alcoholic Fermentation.)

VINUM. (L.) Wine.

VIRULENT. Very poisonous.

VIRUS. Contagous or poisonous matter.

VIS. (L.) Power.

VISCERA. The plural of viscus; the entrails.

VISCERAL. Belonging to the viscera.

VISCID. Adhering; sticky.

VISCOUS. Very glutinous; adhesive.

VISCOUS FERMENTATION. A fermentation which takes place in certain complex saccharine and mucilaginous mixtures.

VISCUS. (L. Plural, Viscera.) Any large organ contained in the splanchnic cavities, such as the lungs, liver, spleen, etc. There are three groups of viscera, namely: The cranio-spinal viscera, those of the thorax, and those of the abdomen. To the first group belong the brain, spinal cord, and organs of sense; to the second, the heart, liver, and organs of respiration; to the third, the pancreas, spleen, stomach, kid-

neys, bladder, and organs of generation.

VITAL. Connected with life.

VITREOUS. Made of or resembling glass.

VITREOUS HUMOR. A glass-like, transparent body, occupying the globe of the eye.

VITRIOL. A name given to certain sulphates on account of their glass-like appearance.

VITRIOL, BLUE. Sulphate of copper.

VITRIOL, GREEN. Sulphate of iron.

VITRIOL, OIL OF. Sulphuric acid.

VITRIOL, WHITE. Zinc Sulphate.

VITRIOLATED SODA. Sulphate of soda.

VITRIOLATED TARTAR. Sulphate of potassa.

VITRIOLIC ACID. Sulphuric acid.

VOLATILE. Disposed to pass off by spontaneous evaporation; easily reducible to vapor.

VOLATILE ALKALI. An old name for ammonia gas.

VOLUMETRIC ANALYSIS. Chemical analysis by means of measured volumes of solutions of reagents of known strength.

VOLUNTARY. Relating to the will; spontaneous.

VOMER. (L.) A small, thin bone in the median line, forming the principal portion of the partition of the nostrils.

VULNUS. (L.) A wound.

W.

W. Symbol for tungsten (Wolfram.)

WART. An induration and elevation of the cuticle.

WASH. A lotion.

WATER. (See *Aqua*.)

WATER-BATH. A device for keeping a substance at a high temperature, but below the boiling-point. It is usually in the form of a hollow

vessel containing boiling water, in the vapor of which the substance is warmed.

WATER-CURE. The treatment of diseases with water.

WATER-GAS. An illuminating gas, obtained by passing steam over ignited carbon. It is composed of hydrogen, carbonic oxide, and carbonic acid, in various proportions, naphthalized with benzine or the volatile hydrocarbon of coal-tar.

WATER-GLASS. (Soluble Glass.) Alkaline silicates used for covering surfaces with a durable coat resembling glass. (See Silicate of Potassa and Silicate of Soda.)

WATER OF AMMONIA. (See Ammonia Gas, page 220.)

WAX. An amber-yellow, fatty solid substance, produced by bees, and used by them in the construction of their cells.

WAX, WHITE. (See *Cera Alba*.)

WAXED CLOTH. A cloth prepared for wrapping the bodies of the dead. It can be made by spreading upon linen or muslin a mixture composed of eight parts of white wax, four of olive oil, and one of turpentine, melted together.

WEIGHT. The downward pressure of bodies, due to gravity.

WEIGHT, ATOMIC. (See page 115.)

WEN. An encysted tumor.

WHEY. The serum, or watery part of milk.

WHISKEY. } (See *Spiritus Fru-*
WHISKY. } *menti*.)

WHITE ARSENIC. (See Acid, Arsenious.)

WHITE BALSAM. (See Balsam of Peru.)

WHITE BISMUTH. (See Bismuth Subnitrate.)

WHITE COPPERAS. A mineral of a white, yellowish, or brownish color, and astringent taste, consisting chiefly of sulphuric acid, peroxide of iron, and water.

WHITE FLUX. A preparation

formed by deflagrating cream of tartar with twice its weight of nitre.

WHITE LEAD. (See Carbonate of Lead.)

WHITE OXIDE OF BISMUTH. (See Bismuth Teroxide.)

WHITE PRECIPITATE. (See Ammoniated Mercury.)

WHITE TURPENTINE. A yellowish-white turpentine obtained from the *Pinus palustris*, and also from the *P. tæda*. It is of a peculiar, aromatic odor and warm, pungent taste. When fresh it affords about seventeen per cent of volatile oil.

WHITE VITRIOL. (See Sulphate of Zinc.)

WHITE WAX. (See *Cera Alba*.)

WHITE-WINE VINEGAR. A vinegar one-sixth stronger than pure malt vinegar. The best comes from France.

WHITE WINES. Wines prepared from white grapes or from the juice of black grapes fermented apart from their skins.

WHITING. A substance much used for polishing metal and for other purposes. It is made by the pulverization and elutriation of crude chalk.

WHITLOW. Abscess of the ends of the fingers.

WHOOPIING-COUGH. An infectious disease chiefly affecting children, and accompanied by a peculiar spasmodic cough.

WINDING SHEET. A sheet in which a corpse is wound or wrapped.

WINE, AROMATIC. A wine prepared by impregnating claret with sage, thyme, hyssop, spearmint, wormwood, and origanum.

WINE OF ANTIMONY. (See Poisons.)

WINE, VINEGAR. (*Acetum Gallicum*.) A vinegar prepared by the acetification of wine.

WINTERGREEN. (*Chimaphila umbellata*.) An aromatic, creeping evergreen, having bright red berries. (See Antiseptics.)

WOOD ALCOHOL. (See Alcohol, Methyl.)

WOOD SPIRIT. (See Alcohol, Methyl.)

WOOD SORREL. *Oxalis acetosella*.) A small plant, from which is obtained the binoxalate of potassa or salt of sorrel, or essential salt of lemons. It is poisonous, and is used for removing ink-stains, etc. (See Poisons.)

WOOD TAR. A product of the dry distillation of wood, being a mixture of various oils and volatile crystalline solids.

WOOD VINEGAR. A name given to the acetic acid obtained by the distillation of wood; it contains wood spirit and creasote.

WOORALI.

WOORARA.

WOORARI.

WORMWOOD. (See *Absinthum*.)

X.

XANTHIC OXIDE. (See page 208.)

XANTHIN. (See page 208.)

XANTHOGEN. A variety of the coloring matter of vegetables, producing a yellow color with alkalies.

XANTHOPSIA. A jaundiced vision.

XANTHOS. (G.) Yellow.

XANTHOXYLENE. A liquid, volatile oil isomeric with oil of turpentine, obtained from the *Xanthoxylum alatum*.

XAXOS. The name of the Guanche mummies. See page 33.

XIPHOID. Sword-like; name of a cartilage of the sternum.

XYLENE. (See Xylol.)

XYLIC ALCOHOL. A principle in coal tar which adheres tenaciously to carbolic acid, and causes it to become brown on exposure to the air.

XYLIC ACID. An acid obtained by the action of sodium on the bromine compound of xylol in a stream of carbonic acid.

XYLITE. A volatile, alcoholic liquid, obtained from pyroxylic spirit.

XYLITIC ACID. (See Xylic Acid.)

XYLOIDIN. An explosive compound made by the action of strong nitric acid upon starch or woody fiber.

XYLOL. (Xylene.) A product of coal-tar. When pure it is a liquid of an aromatic odor, insoluble in water, soluble in ether, and sparingly soluble in alcohol.

XYLONITE. A name given to the peculiar substance derived from woody fiber.

XYLITIC. (See Xylic acid.)

: Y.

Y. Symbol for yttrium.

YEAST. (*Cerevisiae Fermentum*.)

A peculiar product which collects upon the surface of beer while fermenting.

YELLOW COPPERAS. A mineral of a yellow color, and pearly luster, consisting chiefly of sulphuric acid, oxide of iron, and water.

YELLOW FEVER. A dangerous pestilential fever of a special type highly contagious under certain conditions. It is usually characterized by rigors, violent headache, pain in the back and limbs, and high temperature with nausea and vomiting.

YELLOW OXIDE OF MERCURY. A monoxide of mercury obtained by precipitation from a solution of nitrate of mercury by treating the latter with caustic potash.

YELLOW IODIDE OF MERCURY. A yellow powder obtained by precipitating nitrate of mercury with iodide of potassium to which iodine has been previously added.

YELLOW SULPHATE OF MERCURY. (See Poisons.)

YTRIA. A soft white powder insoluble in water, having the formula, Y_2O_3 .

YTRIUM. A very rare metal, of grayish-black color and metallic luster.

Z.

ZEINE. The gluten of maize or Indian corn.

ZIEGA. Curd produced from milk by adding acetic acid after rennet has ceased to cause coagulation.

ZINC. (*Zincum*.) A white metal, less malleable than copper, lead, or tin, though not brittle. Zinc is not acted upon by moist or dry air, and hence it is largely used in the form of sheets, and is employed as a protective covering for iron, which when thus coated is said to be galvanized.

ZINC ACETATE. A salt formed by the solution of acetate of lead in water, to which granulated zinc is added.

ZINC BUTTER. Chloride of zinc.

ZINC, CARBONATE OF. (See Carbonate of Zinc.)

ZINC CHLORIDE. A salt which may be obtained by dissolving zinc in hydrochloric acid. It has antiseptic properties. (See Antiseptics.)

ZINC, GRANULATED. A form of metallic zinc obtained by pouring melted zinc into cold water in a thin stream.

ZINC, SOLUTION OF CHLORIDE. (See Antiseptics.)

ZINC SULPHATE. (See Sulphate of Zinc.)

ZINC VITRIOL. (See Sulphate of Zinc.)

ZINCUM. (L.) Zinc.

ZINGRITIS. A stone resembling glass supposed by the ancients to possess medicinal virtue.

ZIRCONIA. An oxide of zirconium.

ZIRCONIUM. A rare metal, somewhat resembling antimony.

ZN. Symbol for zinc.

ZOE. (G.) Life.

ZOOGLOEA. Immobile masses of

bacteria held together by a sort of jelly.

ZOOLOGICAL. Pertaining to zoology.

ZOOLOGY. The science of animal life.

ZOSTER. A kind of herpes which extends round the body like a zone or girdle.

ZYGAPOPHYSIS. The process of a vertebra by which it is joined to an adjoining vertebra.

ZYGOMA. The cheek-bone.

ZYGOMATIC. Pertaining to the zygoma.

ZYGOMATIC ARCH. The bony arch which connects the malar bone with the squamous portion of the temporal bone, and incloses the temporal muscle.

ZYMOGEN. A substance found in the pancreas which causes the ferment called trypsin.

ZYMOMA. (G.) A ferment; leaven.

ZYMOSES. Fermentation.

ZYMOTIC. A term applied to those diseases which seem to be occasioned by a virus or poison operating like leaven.

TABLES OF WEIGHTS, MEASURES AND SPECIFIC GRAVITIES.

TABLE I.

WEIGHTS AND MEASURES OF THE UNITED STATES PHARMACOPŒIA.

One Pound,	lb.	=	12 Ounces	=	5,760 Grains.
One Ounce,	$\bar{z}$.	=	8 Drachms	=	480 Grains.
One Drachm,	3.	=	3 Scruples	=	60 Grains.
One Scruple,	℥.	.	.	.	20 Grains.
One Grain,	gr.	.	.	.	1 Grain.
One Gallon,	C.	=	8 Pints	=	61,440 Minims.
One Pint,	O.	=	16 Fluid ounces	=	7,680 Minims.
One Fluid ounce,	f. $\bar{z}$	=	8 Fluid drachms	=	480 Minims.
One Fluid drachm,	f. 3.	.	.	.	60 Minims.
One Minim,	min.	.	.	.	1 Minim.

TABLE II.

WEIGHTS AND MEASURES OF THE METRICAL SYSTEM.

Measures of Length.

One Myriametre	=	10,000 Metres.
One Kilometre	=	1,000 Metres.
One Hectometre	=	100 Metres.
One Decametre	=	10 Metres.
One Metre	=	the ten-millionth part of a quarter of the meridian of the earth.
One Decimetre	=	the tenth part of one Metre, or 0.1 Metre.
One Centimetre	=	the hundredth part of one Metre, or 0.01 Metre.
One Millimetre	=	the thousandth part of one Metre, or 0.001 Metre.

Weights.

One Myriagramme	=	10,000 Grammes.
One Kilogramme	=	1,000 Grammes.
One Hectogramme	=	100 Grammes.
One Decagramme	=	10 Grammes.
One Gramme	=	the weight of a cubic Centimetre of water at 4° C.
One Decigramme	=	the tenth part of one Gramme, or 0.1 Gramme.
One Centigramme	=	the hundredth part of one Gramme, or 0.01 Gramme.
One Milligramme	=	the thousandth part of one Gramme, or 0.001 Gramme.

TABLE III.

RELATIONS OF METRICAL WEIGHTS TO WEIGHTS OF THE UNITED STATES PHARMACOPŒIA.

Metrical Weights.	Exact Equivalents in Grains.	Approximate Equivalents in Grains.	Metrical Weights.	Exact Equivalents in Grains.	Approximate Equivalents in Troy Weight.
MILLIGRAMMES.			GRAMMES.		
3	=	.0463	1	=	15.434 gr. xv.
1	=	.0154	2	=	30.868 drs. ss.
2	=	.0308	3	=	46.302 scr. ij.
4	=	.0617	4	=	61.736 drs. j.
5	=	.0771	5	=	77.170 scr. iv.
6	=	.0926	6	=	92.604 drs. iss.
7	=	.1080	7	=	108.038 scr. vss.
8	=	.1234	8	=	123.472 drs. ij.
9	=	.1389	9	=	138.906 scr. vij.
CENTIGRAMMES.			DECAGRAMMES.		
1	=	.1543	1	=	154.340 drs. iiss.
2	=	.3086	2	=	308.680 drs. v.
3	=	.4630	3	=	463.020 drs. viiss.
4	=	.6173	4	=	617.360 drs. x.
5	=	.7717	5	=	771.701 drs. xij.
6	=	.9260	6	=	926.051 drs. xv.
7	=	1.0803	7	=	1,080.381 drs. xvij.
8	=	1.2347	8	=	1,234.721 drs. xx.
9	=	1.3890	9	=	1,389.062 drs. xxij.
DECIGRAMMES.			HECTOGRAMMES.		
1	=	1.543	1	=	1,543.402 oz. iij scr. v.
2	=	3.086	2	=	3,086.804 oz. vj drs. iij.
3	=	4.630	3	=	4,630.206 oz. ix drs. v.
4	=	6.173	4	=	6,173.609 lb. j drs. vij.
5	=	7.717	5	=	7,717.011 lb. j oz. iv.
6	=	9.260	6	=	9,260.413 lb. j oz. vij.
7	=	10.803	7	=	10,803.816 lb. j oz. x drs. iv.
8	=	12.347	8	=	12,347.218 lb. ij oz. j drs. v.
9	=	13.890	9	=	13,890.620 lb. ij oz. v.
			KILOGRAMME.		
			1	=	15,434.023 lb. ij oz. viij.
			MYRIAGRAMME.		
			1	=	154,340.23 lb. xxvj oz. ix drs. iv.

TABLE IV.

RELATION OF WEIGHTS AND MEASURES OF THE UNITED STATES PHARMACOPŒIA TO EACH OTHER.

In Distilled Water at the Temperature of 60°.

One Pound	=	0.7900031	Pint	=	6067.2238	Minims.
One Ounce	=	1.0533376	Fluid ounces	=	505.6019	Minims.
One Drachm	=	1.0533376	Fluid drachms	=	63.2002	Minims.
One Scruple	=			=	21.0667	Minims.
One Grain	=			=	1.0533	Minims.
One Gallon	=	10.1265427	Pounds	=	58328.8862	Grains.
One Pint	=	1.2658178	Pounds	=	7291.1107	Grains.
One Fluid ounce	=	0.9493633	Ounce	=	455.6944	Grains.
One Fluid drachm	=	0.9493633	Drachm	=	56.9618	Grains.
One Minim	=			=	0.9493	Grain.

TABLE V.

RELATION OF MEASURES OF THE UNITED STATES PHARMACOPŒIA TO CUBIC MEASURE.

One Gallon	=	231.000	Cubic inches.
One Pint	=	28.875	Cubic inches.
One Fluid ounce	=	1.80468	Cubic inches.
One Fluid drachm	=	0.22558	Cubic inch.
One Minim	=	0.00375	Cubic inch.

TABLE VI.

RELATION OF WEIGHTS OF THE UNITED STATES PHARMACOPŒIA TO METRICAL WEIGHTS.

Fractions of a Grain in Milli-grammes.			Grains in Equivalent Metri- cal Weights.		Drachms, Ounces, and Pounds in Equivalent Met- rical Weights.			
GRAIN.	MILLIGRAMMES.		GRAINS.	CENTIGRAMMES.	DRACHMS.	GRAMMES.		
$\frac{1}{64}$	—	1.012	1	—	6.479	1	—	2.887
$\frac{1}{56}$	—	1.079			DECIGRAMMES.	2	—	7.775
$\frac{1}{50}$	—	1.295						DECAGRAMMES.
$\frac{1}{48}$	—	1.349	2	—	1.295			
$\frac{1}{40}$	—	1.619	3	—	1.943	3	—	1.166
$\frac{1}{36}$	—	1.799	4	—	2.591	4	—	1.555
$\frac{1}{30}$	—	2.159	5	—	3.239	5	—	1.943
$\frac{1}{28}$	—	2.591	6	—	3.887	6	—	2.332
$\frac{1}{24}$	—	2.699	7	—	4.535	7	—	2.721
$\frac{1}{20}$	—	3.239	8	—	5.183	OUNCES.		
$\frac{1}{18}$	—	4.049	9	—	5.831	1	—	3.1103
$\frac{1}{15}$	—	4.319	10	—	6.479	2	—	6.2206
$\frac{1}{12}$	—	5.399	12	—	7.775	3	—	9.3309
$\frac{1}{10}$	—	6.479	15	—	9.718			
$\frac{1}{8}$	—	8.098			GRAMMES			HECTOGRAMMES.
$\frac{1}{6}$	—	10.798	16	—	1.036	4	—	1.2441
$\frac{1}{5}$	—	12.958	20	—	1.295	5	—	1.5551
$\frac{1}{4}$	—	16.197	24	—	1.555	6	—	1.8661
$\frac{1}{3}$	—	21.597	25	—	1.619	7	—	2.1772
$\frac{1}{2}$	—	32.395	30	—	1.943	8	—	2.4882
			40	—	2.591	9	—	2.7992
			50	—	3.239	10	—	3.1103
			60	—	3.887	11	—	3.4213
						POUNDS.		
						1	—	3.7324
						2	—	7.4648
								KILOGRAMMES.
						3	—	1.1197

TABLE VII.

Specific Gravities corresponding to Degrees of Baumé's Hydrometer for Liquids heavier than Water. (Water=1.00.)

Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.
0	1.000	20	1.152	40	1.357	60	1.652
1	1.007	21	1.160	41	1.369	61	1.670
2	1.013	22	1.169	42	1.382	62	1.689
3	1.020	23	1.178	43	1.395	63	1.708
4	1.027	24	1.188	44	1.407	64	1.727
5	1.034	25	1.197	45	1.420	65	1.747
6	1.041	26	1.206	46	1.434	66	1.767
7	1.048	27	1.216	47	1.448	67	1.788
8	1.056	28	1.225	48	1.462	68	1.809
9	1.063	29	1.235	49	1.476	69	1.831
10	1.070	30	1.245	50	1.490	70	1.854
11	1.078	31	1.256	51	1.495	71	1.877
12	1.085	32	1.267	52	1.520	72	1.900
13	1.094	33	1.277	53	1.535	73	1.924
14	1.101	34	1.288	54	1.551	74	1.949
15	1.109	35	1.299	55	1.567	75	1.974
16	1.118	36	1.310	56	1.583	76	2.000
17	1.126	37	1.321	57	1.600		
18	1.134	38	1.333	58	1.617		
19	1.143	39	1.345	59	1.634		

Specific Gravities on Baumé's Scale for Liquids lighter than Water.

Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.	Degrees Baumé.	Specific Gravity.
10	1.000	23	0.918	36	0.849	49	0.789
11	0.993	24	0.913	37	0.844	50	0.785
12	0.986	25	0.907	38	0.839	51	0.781
13	0.980	26	0.901	39	0.834	52	0.777
14	0.973	27	0.896	40	0.830	53	0.773
15	0.967	28	0.890	41	0.825	54	0.768
16	0.960	29	0.885	42	0.820	55	0.764
17	0.954	30	0.880	43	0.816	56	0.760
18	0.948	31	0.874	44	0.811	57	0.757
19	0.942	32	0.869	45	0.807	58	0.753
20	0.936	33	0.864	46	0.802	59	0.749
21	0.930	34	0.859	47	0.798	60	0.745
22	0.924	35	0.854	48	0.794		

TABLE VIII.

For Converting Degrees of the Centigrade Thermometer into Degrees of Fahrenheit's Scale.

Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
—90°	—130°	— 60°	— 76°	— 30	— 22°
85	121	55	67	25	13
80	112	50	58	20	4
75	103	45	49	15	+ 5
70	94	40	40	10	14
65	85	35	31	5	23
0°	+ 32°	+100°	+212°	+200	+392°
+ 5	41	105	221	205	401
10	50	110	230	210	410
15	59	115	239	215	419
20	68	120	248	220	428
25	77	125	257	225	437
30	86	130	266	230	446
35	95	135	275	235	455
40	104	140	284	240	464
45	113	145	293	245	473
50	122	150	302	250	482
55	131	155	311	255	491
60	140	160	320	260	500
65	149	165	329	265	509
70	158	170	338	270	518
75	167	175	347	275	527
80	176	180	356	280	536
85	185	185	365	285	545
90	194	190	374	290	554
95	203	195	383	295	563

To Convert F. into C. degrees and C. into F. degrees.

$$\frac{(F. - 32) \times 5}{9} = C.^{\circ}; \text{ or } (F.^{\circ} - 32) \div 1.8 = C.^{\circ}$$

$$\frac{C.^{\circ} \times 9}{5} + 32 = F.^{\circ}; \text{ or } (C.^{\circ} \times 1.8) + 32 = F.^{\circ}$$

1° C.	—	1.8° F.
2	—	3.6
3	—	5.4
4	—	7.2

GLOSSARY OF DISEASES.

MODES OF DEATH.

WITH A BRIEF DESCRIPTION OF THE PATHOLOGICAL CHANGES IN THOSE DISEASES WHICH USUALLY PRODUCE DEATH, AND THE ESPECIAL PRECAUTIONS WHICH ARE NECESSARY FOR THE PRESERVATION OF THE BODIES OF THOSE WHICH REQUIRE UNUSUAL ATTENTION:

N. B.—Those diseases which are contagious are marked with *.

All forms of death, according to Bichat's classification, are due either to, (a) death beginning at the *heart*, (b) death beginning at the *lungs*, or (c) death beginning at the *head*. This classification is convenient, for though death beginning at the head is in reality death by the failure of the circulation, or respiration, or both, through affection of the vital nerve centers, yet the affection of the nervous system is the primary fact, and the phenomena are sufficiently characteristic to deserve separate consideration.

"It must, however, always be borne in mind that owing to the interdependence of all the vital functions there is no such sharp line of demarcation between the different modes of death, but we make between them for the purpose of classification, the following division:

1. *Death from the failure of circulation.* This may be sudden, as in *syncope* and *shock*, or it may be gradual as in *asthenia*, or (2), *Death from sudden failure of the respiration.* For an efficient circulation it is necessary that there should be a sufficient quantity of blood or vascular tension, and a different tension in the arteries as compared with the veins. The circulation will be brought to a standstill by any cause which greatly lowers the vascular tension or annihilates the differential pressure in the arterial system. The cause may be in the heart, or in the vessels, or both. *The usual causes of sudden death*, which are described more at length under their appropriate headings are either apoplexy; valvular heart disease (especially mitral); rupture of heart (or syncope) in fatty degeneration; bursting of aneurism, or abscess, within the thorax or abdomen; suffocation and violent mental shock or alarm.

The immediate cause of all death, according to Hartshorne, is either, (1), by *asthenia*: the dynamic force of the system being exhausted or destroyed, so that the heart ceases to beat, as in lightning-stroke, poisoning by prussic acid etc. Syncope (or fainting) simulates or threatens this. (2) By *anæmia*: the blood being rendered insufficient for life; as from hemorrhage after labor, surgical injuries, bursting of aneurism. (3) By *apnoea*, or *asphyxia*: that is

arrest of respiration, either from disease of the lungs, obstruction of the air-passages, deficiency or impurity of the air. (4) By coma: the brain and medulla being made incapable of sustaining innervation; as in apoplexy, opium poisoning, etc. Preliminary to these final causes of death are the diseases which ordinarily prove fatal, and whose characteristic lesions are briefly described in the following alphabetical list:

A.

ABDOMINAL DROPSY. (See Ascites.)

ABSCESS. Small quantities of pus in an unopened cavity are of little importance unless they are reabsorbed by the circulation when they produce pyæmia. Large abscesses may cause death from exhaustion, or septicæmia, or re-deposition of pus elsewhere producing metastatic abscesses which cause, according to Lawrence Johnson, waxy kidney, liver or spleen. (See Pyæmia, Septicæmia and Amyloid.)

ABSCESS OF THE BRAIN produces death by convulsion, paralysis or coma.

ABSCESS OF THE LIVER usually produces death by peritonitis, except when rupture takes place into the lungs. (See Peritonitis.)

ABSCESS OF THE LUNG should be treated after death, as a case of phthisis.

ABSCESS, RETROPHARYNGEAL is an abscess occurring between the backbone and pharynx; and may suddenly produce death by asphyxia or, gradually, from exhaustion. (See Pott's Disease.)

ACINESIA. (See Lexicon.)

ACNE. (See Lexicon.)

ACUTE PHTHISIS (Galloping Consumption) differs from ordinary consumption, only in the rapidity of its course. Cavities, infiltration, and inflammation of the lungs are found in both cases after death. In all such cases, the lungs require special injection with antiseptic fluids, both by means of the hollow needle and directly into the trachea: which should be performed before arterial injection is resorted to. In all such cases, great care should be taken, and little force should be used, in order that frothing from the mouth may be avoided. (See Tuberculosis.)

ACUTE SOFTENING OF THE STOMACH is in a great majority of cases a post-mortem change rather than a distinct disease. In such cases the tissues of the stomach are gelatinous and easily rupture if any force is used.

ACUTE YELLOW ATROPHY OF THE LIVER most frequently follows phosphorus or other poisoning. After death, the liver is found flattened, about half its normal size, and with a yellow color like rhubarb,

from fatty degeneration. The kidneys are also found similarly affected, and the whole body is intensely jaundiced. Death, in these cases, apparently results from uræmia, which see.

ADDISON'S DISEASE. (See *Melasma supra-renal.*)

ADENIE. (F.) A name given by Trousseau to Hodgkin's disease, which see.

AGUE. (See *Intermittent Fever.*)

AGUE CAKE. (S.) (See *Lexicon.*)

ALCOHOL. Poisoning from, acute and chronic. The different preparations of alcohol may, when taken in large quantities, produce sudden coma and death. The bodies are said to resist decomposition for an unusual length of time. There is congestion, and sometimes extravasation of the blood in the brain: the veins everywhere are full of blood, and the bladder distended with urine. Chronic alcoholic poisoning is of a different nature; in this latter case the brain appears normal, but the lungs are usually congested.

ALBUMINURIA (S.), is the presence of albumen in the urine, and may result from a variety of renal diseases, among which are acute desquamative nephritis, non-desquamative nephritis, amyloid kidney, and chronic Bright's disease, which see. Death in these cases results from hydræmia and the accumulation of urea in the system. (See *Uræmia* and *Dropsy.*)

ALOPECIA. (See *Lexicon.*)

AMAUROSIS. (See *Lexicon.*)

AMBLYOPIA. (S.) (See *Lexicon.*)

AMENORRHEA. (See *Lexicon.*)

AMYLOID DEGENERATION is a change which may take place in any organ whereby it loses its natural color, and is converted into a pale, lardaceous substance, with the loss of its proper functions. Some think this change is due to the reabsorption of pus. Death, in these cases, results from profound anæmia, emaciation, and often dropsy, which see.

AMMONIA. Poisoning from. Ammonia swallowed or inhaled acts as an irritant poison—(See *Poisons*), and thus the vapor of strong ammonia may cause death from inflammation of the larynx and air passages. But the strong solution of ammonia produces corrosion of the mouth, œsophagus and stomach. (See *Gastritis.*)

ANÆMIA (*Sputæmia*, *Hydræmia*), is used to denote that condition of the system in which the density of the blood is diminished, and there is deficiency in the blood corpuscles. Where death occurs, in such cases, it is preceded by general wasting of the body, absence of fat, and occasionally dropsy, which see.

ANÆSTHESIA. (See *Lexicon.*)

ANEURISM. A circumscribed dilatation of an artery, dependent on a lesion of its coats. True aneurism, is that in which all the coats of an artery dilate and unite in forming walls of the pouch; *false* aneurism, in which inner and middle arterial tunics being ruptured, walls are formed by cellular coat and contiguous parts: and *mixed* or *consecutive false* aneurism, in which the three coats having at first dilated, inner and middle ones subsequently rupture as distension increases; *Varicose* aneurisms are those where a communication has formed between aorta and either of the venæ cavæ, or between this vessel and right ventricle, or between aorta and pulmonary artery. Death from aneurism results from its rupture into one of the cavities and syncope from hemorrhage. In such cases arterial injection is impossible until the rupture can be found and the artery ligated above and below.

ANGINA PECTORIS. An affection characterized by a sudden severe burning or constricting neuralgic pain or spasm of a weakened heart, referred to the lower end of the sternum, extending through the chest to the left scapula, and up the sternum to the root of the neck. A tendency to syncope exists, associated with intense anxiety, and a sensation of approaching dissolution, which may ensue from heart failure.

***ANTHRAX** (See Carbuncle). Not infrequently causes death by re-absorption of the purulent or gangrenous matter arising from the sloughing of tissues. (See Septicæmia and Embolism.)

APHONIA. (Loss of voice.) An affection of the larynx, causing the voice to be whole or partially lost, the patient speaking in a whisper. (S.)

APHTHÆ. An ulceration of a mucous membrane, beginning in numerous minute vesicles, and terminating in white sloughs.

APOPLEXY. A cerebral disease, characterized by a sudden loss, more or less complete, of volition, perception, sensation and motion, depending on sudden pressure on the brain, due to rupture of a blood vessel within the cranium, and the formation of a blood clot. The walls of the blood vessels in such cases will usually be found to have undergone fatty or calcareous degeneration, and a similar condition generally exists elsewhere in the body. Hence great care must be taken in using arterial injections which should be given by preference through the brachial or carotid arteries.

ARSENIC. Poisoning from. After death from arsenical poisoning the stomach may be empty or contain mucus mixed with blood, and the intestines contain a white, rice-water fluid, which must be emptied out. The pathological changes are those of gastritis and enteritis, which see.

ARTHRITIS. (See Gout and Rheumatism.)

ASCITES. (S.) A collection of serum in the cavity of the peritoneum, usually known as dropsy of the abdomen. The preservation of such bodies can be greatly aided by removing this fluid by means of a trocar

plunged into the median line of the abdomen about midway between the umbilicus and pubes. After the water has been drawn away, arterial injection, if properly done, is usually entirely successful.

ASTHMA. A paroxysmal nervous difficulty in the breathing dependent on a tonic spasm of the circular fibers of the smaller bronchioles. The breathing is accompanied by a wheezing sound, a sense of constriction in the thorax, great anxiety and a difficult cough. Patient cannot recline, expects immediate death, which, however, rarely if ever, is produced by asthma.

ASTIGMATISM. A defect in the eye, in which the rays are not brought into one focus, but converge at different distances, so as to form two linear images at right angles with each other.

B.

BALANITIS. An aphthous inflammation of the glans penis and prepuce, which should not be mistaken for syphilis. (See Syphilis.)

* **BLOOD POISONING.** The popular name given to septicæmia or the reabsorption of dead matter by the circulation and poisoning therefrom. This may arise from poison produced within the body. (See Carbuncle, Confinements, etc.), or from inoculation of virus from a poisonous corpse. (See Wounds, poisoning from.) In either case the post-mortem appearances are those of septicæmia and pyæmia. It will be found such bodies are very difficult to preserve, for decomposition of tissues has commenced before death. Therefore, the strongest available injections should be used, and continued by hypostatic pressure until the antiseptic and disinfectant fluid begins to ooze through incisions made in the tops of the toes, after the method recommended by Richardson. (See page 284.) Others advise that the blood be drawn off from the heart and vessels as far as possible to prevent its early decomposition; and dropsy, if present, should be treated as elsewhere directed.

BOILS. (Furuncles.) A small inflammatory tumor, never fatal.

BRAIN, DISEASES OF. (*Anæmia.*) A condition due to general diminution of blood, local abstraction of blood, congestion of organs, diminished heart's actions, compression or obstruction of arteries supplying the brain, diminution of the size of the cranial cavity by tumors, exudations, etc.; may prove fatal by syncope.

Hyperæmia, of. A condition depending on increased heart's action, slight resistant power of cranial blood vessels, increased lateral pressure in the carotids, paralysis of the vasomotor nerves of the brain, compression of the jugular veins, energetic respiratory movements, excessive eating and drinking. May produce death, either by apoplexy or meningitis, which see.

BRIGHT'S DISEASE. (Albuminuria.) A constitutional affection culminating in a variety of structural lesions of the kidneys accompanied by separation of serum from the blood, and its presence in the urine, connective tissues, and cavities of the body, constituting what is usually known as dropsy. For care of dropsical bodies, see dropsy, and for acute Bright's disease, see *Nephritis desquamans acuta*.

BRONCHITIS. An inflammation of the bronchi, or air passages leading to the pulmonary vesicles; the natural secretion at first arrested, but afterward increased. Rarely produces death except in the case of children, or aged people, with whom an extension of the inflammation in the smaller bronchioles (capillary bronchitis) may cause death. In all such cases arterial and inter pulmonary injections may be freely used; for in these cases there is no ulceration or thinning of the walls of the air cells, which are intact but plugged with viscid mucus. Discoloration of the surface of the body is frequent in such cases and should be treated by a proper inclination of the body and the means elsewhere directed.

BRONCHOCELE. (Goitre.) A hypertrophied thyroid gland, causing enlargement of the neck. Not usually fatal except when occurring as a complication of exophthalmic goitre, which see.

***BUBO.** An inflammatory swelling of a lymphatic gland or glands, particularly of the groin or axilla, of a specific or non-specific nature. (See Syphilis.)

BURNS AND SCALDS. Lesions caused by the application of fire or steam, and not infrequently causing irremediable disfigurements of the body. When scalding causes a loosening of the skin this may in a measure be remedied by coating the surface of the cadaver with a thin alcoholic solution of white shellac, applied lightly with a flat varnish brush.

CALCULUS (Renal Colic, Biliary Colic) is the formation of a stony concretion either in the gall bladder, kidneys, or urinary bladder. It may produce death, either from the intense pain produced in its passage, from the rupture of the canal through which it passes, or from general exhaustion produced by the continued irritation of its presence. (See Pyelitis and Cystitis.)

***CAMP FEVER.** (See Typhus.)

CANCER is a malignant growth which may supplant, or take the place of the normal tissues in almost any organ. Cancers are divided into scirrhus, or hard cancer; colloid, or gelatinous cancer; encephaloid, or brain-like cancer. But while they differ somewhat in physical appearance, the tendency of all is to a fatal termination with greater or less rapidity, the scirrhus the slowest in its progress. According to Rokitansky, it attacks the various organs in about the following frequency: 1st, the uterus; 2nd, mamma; 3rd, stomach;

4th, rectum; 5th, lymph-glands; 6th, liver; 7th, bones; 8th, skin; 9th, brain; 10th, eye; 11th, testicle; 12th, ovary; 13th, tongue; 14th, œsophagus.

Cancer is not contagious and need cause no fear in handling the body which, however, it often frightfully disfigures and generally renders unpleasantly fetid even before death. Clarke suggests that in cancer of the face, after thoroughly disinfecting, the sloughing cavity may be filled up with slightly moistened plaster of Paris, which will harden and form an impermeable coating permitting arterial injection, which otherwise would escape through the ulcerated vessels. The same device might be adopted whenever the cancer can be reached, but in the case of internal cancer, as of the stomach, we are obliged to rely largely upon cavity injections. In cancer of the throat and vagina these cavities should be tightly packed with absorbent cotton saturated with some reliable disinfecting fluid.

CANCERUM ORIS (Cankered Sore Mouth) is an ulcerative inflammation of the gums, most frequently observed in children. It is rarely fatal, and should be carefully distinguished from noma, which is sometimes called by the same name, but which is almost invariably fatal.

GLISSON'S CAPSULE, Inflammation of. See Cirrhosis of the liver.

CARBONIC OXIDE, POISONING FROM. This gas is produced from burning charcoal, and forms one of the poisonous ingredients of illuminating gas. For post-mortem appearances, see death from suffocation. When this gas is taken into the lungs, it combines with the reduced hæmoglobin, gives the blood a bright cherry-red color, and destroys its function as an oxygen carrier. Moreover, since this gas is but slowly displaced by oxygen, the animal dies of suffocation. The blood of an animal poisoned with this gas will often hold its color for days or weeks.

CARBOLIC ACID, Poisoning from. A large number of deaths from this poison have been reported within the last few years. In these cases the stomach, lungs and intestines are intensely congested, and moreover it appears to have a specific effect upon the heart's action producing cardiac paralysis.

CARBUNCLE (Anthrax) is an extensive sub-cutaneous inflammation closely resembling a collection of boils. Not usually fatal unless it is so situated, as on the back of the neck, that there may be reabsorption of the dead material, producing septic meningitis. (See Meningitis and Septicæmia.)

CARDIAC EXHAUSTION. See Heart, exhaustion of.

CARDIALGIA. (See Lexicon.)

CATELEPSY. (See Lexicon.)

CATARRH is an excessive discharge from any of the mucous membranes, whether of the nose, mouth, lungs, stomach, intestines or urine

tract. It is a usual accompaniment of the inflammation of these various organs. (See Coryza, Stomatitis, Laryngitis, Bronchitis, Gastritis, Enteritis, Nephritis, Cystitis, etc.)

CATARRH, EPIDEMIC. (See Influenza.)

CATARRHAL CROUP. (See Laryngitis.)

CEPHALGIA. (See Lexicon.)

CEREBRITIS (Encephalitis, Phrenitis) is an inflammation of the brain substance usually accompanied with that of the membranes as well. Post-mortem examinations show that this may be due to a large variety of causes, such as tubercle, acute hydrocephalus, gray granulations, local tumors, etc.

CEREBRO SPINAL FEVER.

CEREBRO SPINAL MENINGITIS,
SPOTTED FEVER,
MALIGNANT PURPURIC FEVER,
EPIDEMIC CEREBRO SPINAL MENINGITIS,
FEBRIS CEREBRO SPINALIS,
FEBRIS PURPUREA PESTIFERA,

A malignant epidemic fever attended by painful contractions of the muscles of the neck, and retraction of the head. In certain epidemics it is accompanied with profuse purpuric eruptions and secondary effusions into the joints and spinal membranes. The blood is also excessive in fibrin, and the brain shows congestion with extensive fluid in the ventricles.

There is no proof of personal contagiousness in cerebro spinal fever, although the bodies of those dying from this disease are prone to rapid decomposition, and need especial promptness in injection.

CHELOID. (See Keloid.)

CHICKEN POX. (See Varicella.)

CHILBLAINS. (See Pernio.)

CHILLS AND FEVER. (See Ague.)

CHLOASMA. (See Lexicon.)

CHLOROSIS is a not infrequent affection of young girls, characterized by a peculiar yellowish or greenish pallor of the face, often accompanied with oedema of the feet and face. Rarely fatal unless it is accompanied with leukæmia, which see.

(HOLEMIA. (See Lexicon.)

*CHOLERA (Malignant Cholera, Spasmodic Cholera, Asiatic Cholera.) An epidemic disease characterized by vomiting and purging, with evacuations like rice water; also accompanied with cramps and suppression of the urine, and early death from collapse. The causation of cholera is as yet unknown; but by many it is supposed to be due to a bacillus which is transmitted from one to another by the cholera dejections. Whether this be true or not, the greatest possible care should be taken in handling the body of one dying from Asiatic cholera, employing all possible anti-septic precautions, and air-tight caskets. Cremation is undoubtedly the

best method of disposing of the bodies and all of the effects of those dying from cholera.

CIRRHOSIS. A consolidation and contraction of tissue most frequently occurring in the liver or lungs. (See Liver, Cirrhosis of, and Consumption, Chronic.)

COMA. (See modes of death.)

CONVULSIONS. (See Eclampsia.)

CONSUMPTION. (See Phthisis.)

***CORROSIVE SUBLIMATE, POISONING FROM.** The stomach is usually contracted; there are inflamed and congested, sometimes *gangrenous*, patches of the mucous coat. The intestines may appear normal, or there may be patches of congestion. In both preceding cases it must be borne in mind that the poison may be absorbed by the skin, therefore the operator should use great care in manipulating the stomach and bowels, but on the other hand, the bodies of those thus dying, as a rule, usually well resist putrefaction.

CORYZA. (See Lexicon.)

COUP de SOLEIL. (See Heat Stroke.)

***COWPOX.** (See Vaccinia.)

COXALGIA. (See Hip Disease.)

CRETENISM. (See Lexicon.)

CYANOSIS. (See Lexicon.)

CYSTITIS. Inflammation of the bladder which may prove fatal from ammonaemia or exhaustion. Same treatment as in uraemia is required.

D.

DENGUE. A continued fever, characterized by frontal headache and severe pains in the limbs, and sometimes by an eruption resembling that of measles. Recovery usually takes place, but convalescence is very slow.

DENTITION INORDINATA. Teething of infancy becomes irregular in many ways not necessary here to discuss, and may become a cause of death by continued reflex irritation in nervously constituted children. (See Eceampsia.)

DEVORANDI DIFFICULTAS. (See Dysphagia) (S.)

DIABETES INSIPIDUS. Excessive flow of non-saccharine urine. (S.)

DIABETES MELLITUS. (Melituria, Paruria, Mellita, Glycosuria, Saccharine Diabetes.) A disease of assimilation whereby starch and saccharine substances instead of nourishing the body pass off from it as glucose in the urine. This stimulates the kidneys to inordinate action which is the most marked symptom of the disease. Death, in diabetes, results from gradual starvation and exhaustion.

DIARRHŒA. Too frequent fecal evacuations, due to irritation of the intestinal mucous membrane. See enteritis, dysentery, typhoid, etc. Profuse or long continued diarrhœa may cause death from exhaustion or serous hemorrhage, in which latter case the blood is found in the condition noted under cholera, which see.

DILATATION OF THE BRONCHI. (See Emphysema.)

DILATATION OF THE HEART. (*Dilatatio cordis.*) Dilatation of the heart may arise from fatty deterioration of the heart muscles (see Atheroma), so that they distend under pressure, or it may accompany hypertrophy resulting from the heart's efforts to perform its work under increased pressure. Death usually takes place from heart failure, or rupture of its walls with immediate death from hemorrhage. If the opening is in the left side of the heart arterial injection may still be resorted to, but it is better in such cases to inject the carotid on one side, and the femoral on the other. Great gentleness should be used in injecting in such cases and the same should be observed in cases of dilatation of any of the arteries. (See Aneurism.)

***DIPHTHERIA.** (*Angina Maligna; Cynanche Membranacea, Putrid Sore Throat, Malignant Quinsy.*) An epidemic and contagious sore throat of great severity, and characterized by swollen glands, exudation of false membranes on tonsils and adjacent structures. The same exudate occurs at times on wounds or by extension from the throat in the windpipe where in young children it is almost invariably fatal. Death may occur from asphyxia, (which see), or from hemorrhage after the separation of the membranous slough, or from toxæmia, for in diphtheria the whole system is infected with its poison from which even in favorable cases it takes months to recover, as also from the paralysis which very frequently follows diphtheria. The bodies of those dying from diphtheria should be treated as those dying from small-pox for diphtheria is almost equally contagious and is frequently disseminated by funerals. In all such cases the most efficient disinfectants should be used and if possible the body should be inclosed in an air-tight casket.

DIPLOPIA. (S.) (See Lexicon.)

DIPSOMANIA. An intense craving for intoxicating liquors.

DISSECTING WOUND. (See Septicæmia.)

DIURESIS. (*Diabetes Insipidus.*) A condition in which an excessive quantity of pale limpid urine is secreted, free from sugar or other abnormal ingredient.

DOLOR FAUCIUM. (Sore throat.) (See Lexicon.)

DROPSY. The accumulation of serous fluids in the cavities or cellular tissue of the body. If generally diffused through the latter it is called anasarca; if confined to the peritoneal cavity it is known as ascites, and elsewhere according to its location as dropsy of the heart, dropsy of the

lungs, etc. Dropsical effusions into the closed sacks can be removed by tapping them with a trocar after death, inclining the body as may be necessary to cause the fluid to escape by gravity. Anasarca of the legs requires that they should be tightly bandaged after cutting shallow incisions through the skin through which the water will gradually escape and the same treatment is appropriate for the arms also. Further directions for the embalming of dropsical subjects can be found on page 267.

DROWNING. Is only one form of death from asphyxia. In such persons the lungs are generally congested, the stomach, contains some of the fluid in which the person has been drowned, and must be emptied out by gravity. The abdominal viscera may also be congested, but the blood generally remains fluid throughout the body, and is easily removed, but these bodies are very prone to turn black on their removal from the water if they have lain there for some days. After a body has become thoroughly bloated it cannot be restored to its natural condition, but this bloating may be prevented by the early and continued use of efficient antiseptics.

DYSENTERY. (*Dysenteria, Bloody Flux.*) An inflammation of the colon and rectum, attended with the frequent passage of mucus and blood followed by straining. Epidemic dysentery is usually accompanied with malarial symptoms and is rapidly fatal from collapse; ordinary dysentery is not so unless it occurs in the aged or those enfeebled by previous disease. Autopsies show redness, swelling, softening and ulceration of the rectum, colon and cæcum occasionally, consequently antiseptic enemata are useful in the preservation of such subjects.

DYSMENORRHEA. (*Paramenia Difficilis Menstrua Dolores.*) Painful menstruation, which is a symptom merely of some organic or functional uterine disease.

DYSPEPSIA. (*Apepsia, Digestio difficultis.*) Difficult or painful digestion, which may be a symptom either of organic disease of the stomach or merely of its functional derangement. (S.)

DYSPHAGIA. (See *Lexicon.*)

DYSPHONIA CLERICORUM. (Clergyman's sore throat.) See *Pharyngitis*.

DYSPNOEA. (*Pseudo-asthma, Respiratio difficultis.*) (See *Lexicon.*)

E.

ECLAMPSIA. The name applied to all varieties of convulsions, from whatever cause, although by some restricted to the convulsions after confinement. (See *Puerperal Convulsions.*) Death may follow convulsions from asphyxia or exhaustion, but the post-mortem appearances are by no means constant, passive hyperæmia of the brain being found in

some cases, arterial in others, cerebral anæmia in others, as well as various brain lesions, such as hydrocephalus, encephalitis, tumors, etc. Again, convulsions arise from alterations in the blood (toxæmia) and in many other cases, absolutely no lesions can be found, for it must be remembered that with children convulsions take the place of a chill with an adult, and consequently may occur whenever an adult might have a chill.

ECLAMPSIA NUTANS. (Salaam Convulsions.) A rare disease of infancy, characterized by frequent bowing motions of the head.

ECSTASY. (See Lexicon.)

***ECTHYMA.** (See Lexicon.)

ECTROPION. (Blepharotösis.) (See Lexicon.)

ECZEMA. (Running Scall, Humid Tetter.) An eruption consisting of minute vesicles upon reddened skin which is somewhat thickened. These vesicles soon fill with an opaque irritating fluid, which forms a yellow scab and excoriates the surrounding skin. Never fatal.

ELEPHANTIASIS. (See Lexicon.)

***ELEPHANTIASIS GRECORUM.** (Elephantiasis anæsthetica; Lazari malum.) See Leprosy.

EMBOLISM. A term used in medicine to denote the detachment of a fibrinous clot in the blood vessels and its being carried forward by the circulation until it becomes impacted in a vessel of too small size to pass through where it remains permanently. Emboli may be either venous or arterial. Vessels most liable to be thus plugged are the arteries of the base of the brain, the internal carotids, and the femoral and brachial. Embolism of the right side of the heart produces pulmonary collapse, partial or entire, as well as pleurisy, pulmonary hemorrhage and bronchitis. Embolism is one of the causes of sudden death after confinement, and also of death from apoplexy, for death occurs in much the larger number of cases of embolism either from the causes just named or septicæmia arising from the decomposition of the clot. Arterial injection is impossible through vessels closed by a fibrinous clot, hence one of the less desirable arteries may have to be selected in such a case, and very likely cavity embalming may be required in addition, if septicæmia has also occurred. (See Septicæmia.)

EMPHYSEMA. (Pneumatosis Pulmonum; Pneumectasis.) Dilatation of the air cells of the lungs attended with gradual effacement of the blood vessels distributed over their walls, resulting in anæmia of the lungs on the affected side. Not usually fatal. (S.)

EMPYEMA. (Pyothorax; Hydrothorax Purulentus.) The formation and accumulation of pus in the pleural cavity. (See Pleurisy.)

ENCEPHALOID CANCER. (Medullary cancer.) (See Lexicon.)

ENCHONDROMA. A cartilaginous tumor.

ENCEPHALITIS. Inflammation of the brain or its membranes, which may produce death from coma, convulsions (effusions) or paralysis, which see.

ENDOCARDITIS. (Internal Carditis.) Inflammation of the lining membrane of the heart and its valves, attended with pain and dyspnoea. Death results from heart failure or emboli sent into the circulation by the breaking loose of fibrinous vegetations which form on the roughened heart valves. Heart clots are also of not infrequent occurrence in endocarditis and may prove a serious obstacle to arterial injection. (See Embolism.)

ENDOCERVICITIS. Inflammation of the neck of the womb } Are

ENDOMETRITIS. (Uterine leucorrhœa; Uterine catarrh.) } usually associated: are not of themselves cause of death, but are symptoms of widely different diseases. (See Leucorrhœa.)

ENDOSTEITIS. Inflammation of the inner portions of the bones. (See Ostitis.)

ENTERIC FEVER. (Typhoid fever, *Febris enterica*.) A continued fever characterized by the presence of rose-colored spots on the abdomen, diarrhœa and ulceration of the glands of the intestines. The disease is very frequently fatal, either from toxæmia, hemorrhage from the bowels, exhaustion or complications, such as pneumonia or brain troubles. Infection in enteric fever is now generally supposed to originate from the typhoid diarrhœa, whose passages should be scrupulously disinfected, but the bodies of those dying of typhoid fever can be safely handled with the ordinary precautions, such as the use of the hollow needle, to draw off the gases which accumulate in the intestines, and the injection through the same of some antiseptic fluid to arrest purging. In all such cases the head should be kept elevated to prevent discoloration of face, and antiseptics and disinfectants should be freely used in the stomach, intestines and peritoneal cavities.

ENTERITIS. (See Lexicon.) Requires the same treatment as typhoid.

ENTROPION. (See Lexicon.)

ENURESIS. (See Lexicon.) (S.)

EPHELIS. (Pl. Ephelides.) (See Lexicon.)

EPILEPSY, is a disease due to a variety of causes, usually located in the brain or spinal cord, and is characterized by eclamptic attacks of increasing severity and frequency until at last the patient dies, either a mental wreck or in a convulsion. For post-mortem appearances see Eclampsia.

EPISTAXIS. (See Lexicon.)

***EQUINIA.** (See Lexicon.)

***ERYSIPELAS.** Is a specific blood disease probably arising from bacterial growths within the system and on the surface of the body. It

is characterized by great heat, swelling, and redness of the affected parts, and may result fatally from exhaustion or blood-poisoning. Puerperal fever is considered by some, a form of internal erysipelas, and the bodies of those dying from erysipelas should receive the same treatment as those after puerperal fever, which see.

ERYTHEMA. (See Lexicon.)

ERYTHROMELALGIA. Is a condition of active hyperæmia and hyperæsthesia of the lower extremities, accompanied with burning pain, redness, increased arterial pulsation and temperature. Not usually fatal.

*EXANTHEMATA. (See Lexicon.)

EXHAUSTION. Is the name given to the general depression of the vital powers; and where it produces death it follows as a result of venous thrombosis or cardiac exhaustion; in the latter case, the heart's action becomes weaker and weaker, with increasing dyspnoea and death usually follows from heart clot.

EXOPTHALMIC GOITRE. (Graves' Disease, Basedow's Disease.) Is an enlargement of the thyroid gland in the neck, prominence of the eyeballs, and overaction of the heart. After death the heart is sometimes found greatly dilated, and at other times the aorta and large vessels are atheromatous and very easily ruptured, hence careful injection is required.

F.

FACIAL PALSY is a paralysis of the motor nerve of the face. It is usually a symptom of the rheumatic inflammation of the nerve sheath, and is not fatal.

*FAMINE FEVER is the name formerly given to relapsing fever, which see.

FATTY DEGENERATION OF THE HEART is an interstitial change (not an accumulation of fat about the heart) whereby the muscles become pale and yellowish, and lose their power of contraction. Death results either from rupture or from failure to carry on the circulation. The same precautions as directed in atheroma should be observed in these cases.

FATTY EMBOLISM is a bit of fatty matter carried along in the circulation until arrested by its size in one of the smaller vessels. (See Embolism.)

FATTY LIVER is the same change occurring in the liver that has already been noted under fatty heart.

*FAVUS. (See Lexicon.)

FEVER, CEREBRAL. (See Cerebro-spinal Meningitis.)

FEVER, INTERMITTENT. (See Malaria.)

FEVER, PERNICIOUS. (See Pernicious Fever.)

*FEVER, PUERPERAL. (See Puerperal Fever.)

FEVER, RELAPSING. (See Relapsing Fever.)

FEVER, REMITTENT. (See Remittent Fever.)

*FEVER, SCARLET. (See Scarlet Fever.)

FEVER, TYPHOID. (See Typhoid Fever.)

FEVER, TYPHO-MALARIAL. (See Typho-malarial Fever.)

*FEVER, TYPHUS. (See Typhus Fever.)

*FEVER, YELLOW. (See Yellow Fever.)

FOLLICULAR PHARYNGITIS. (See Pharyngitis.)

FROST-BITE. (See Pernio.)

G.

GALL BLADDER, AFFECTIONS OF. The gall bladder may be dilated from obstruction of the gall duct, common bile duct, or local dropsy. It may also be filled with gall stones, from which death may result either from exhaustion or perforation of the gall duct from prolonged obstruction and dilatation. These cases may also prove fatal by the production of peritonitis from escape of bile in the peritoneal cavity. (See Peritonitis.)

GALLOPING CONSUMPTION is the name given, formerly, to acute phthisis, and differs from ordinary phthisis pulmonalis in no respect except in the rapidity of its progress. See Tuberculosis.

GALL STONES consist of concretions of cholestearin and other ingredients of the bile, which are deposited from it in the gall bladder, and cause great pain and sometimes death in their passage thence to the duodenum. (See Gall Bladder.)

GANGRENA ORIS. (Gangrene of the Mouth.) (See Lexicon.)

GANGRENE OF THE LUNG is local death of lung tissue, and is almost invariably fatal. After death in these cases, the trachea and bronchioles should be filled with antiseptic fluid, which should be retained there by proper means.

GASTRIC INTERMITTENT FEVER is the name formerly given to the sub-gastritis of children. (See Gastritis.)

ACUTE GASTRITIS, is an inflammation of the stomach, and except from poison or direct injury, is rare. Chronic gastritis is more frequent, but is not usually dangerous to life.

GASTRO-DUODENITIS, OR GASTRO-HEPATIC CATARRH, is a catarrh of the stomach, duodenum and gall duct. Rarely fatal except when it results in a closure of the duct and retention of the gall in the gall bladder. (See Gall-bladder.)

GENERAL PARALYSIS is occasionally met with in the insane, and consists of a gradual loss of all mental, muscular and sensory power. It is incurable, and by some is considered to be due to granular degeneration of the nerve cells.

GIN LIVER is the popular name for cirrhosis of the liver, and consists, at first, in an increase of its bulk and firmness; later it becomes smaller, indurated, and irregular in shape, both the liver-cells and ducts being in considerable part destroyed.

***GLANDERS.** (See Lexicon.)

GLAUCOMA. (See Lexicon.)

GLYCOSURIA. (See Diabetes mellitus.)

GOITRE. (Bronchocele) is an enlargement of the thyroid glands, and except in case of ex-ophthalmic, which see, death rarely results from this affection.

GONORRŒA. (See Lexicon.)

GOUT (Podagra) a constitutional disease attended with paroxysmal attacks, pain and local swelling especially about the toes. Except in case of retrocedent, or misplaced gout; that is, that in which some internal organ (as the stomach or heart,) is affected, gout is rarely fatal, though an extremely painful disease.

GOUTY COLIC is retrocedent gout of the stomach.

GRAVEL. (Lithiasis) is the formation of calculous deposits in the kidneys or bladder. Death may result from the extreme pain, or from secondary trouble set up in the bladder or kidneys. (See Nephritis, Cystitis.)

GRAVES DISEASE. (See Ex-ophthalmic goitre.)

H.

HAEMATEMESIS. (See Lexicon.)

HAEMATURIA. (See Lexicon.)

HEAMOPHILIA (Hemorrhagic Diathesis) is the name given to that condition of the system in which continued bleeding follows the slightest operation or wound. It may be due either to defect in the walls of the blood-vessels or faulty composition of the blood. Death in such cases results from exhaustion, and such bodies are found extremely anæmicæ. See Anaemia.

HAEMORRHAGE is a symptom of many diseases in which death usually results from other causes than the loss of blood. Death from hemorrhage is always due to exhaustion and syncope.

HÆMMORRHOIDS. See Lexicon.

HAY FEVER. The name given autumnal catarrh or asthma; by some supposed to be due to the pollen of plants flowering at that time; others consider it a neurosis.

HEART CLOT is a fibrinous clot taking place in the heart before death. An ante-mortem clot, is distinguished from a post-mortem clot; first, by the former filling its cavity; second, by its being grooved by the current of

blood; third, by its being adherent to the walls of the heart or vessels; and fourth by its structure being laminated.

HEART DILATATION is a complication accompanying either debilitated cardiac muscles, valvular disease, or obstruction in the organs remote from the heart, as Bright's disease of the kidneys. It may, or may not, be accompanied by hypertrophy of the heart. All cases of death from heart disease are apt to be attended with a fullness of the venous system and sometimes of the arterial also. This may be relieved in a measure by tapping the heart with a hollow needle and allowing the blood to gravitate from the head and face by a proper inclination of the body. For directions for locating the heart, see page 66.

HEAT STROKE (Sun Stroke, *Insolatio*, *Coup de Soleil*) is, probably, of two varieties, one of which causes congestion of the brain, and the other has, in addition, blood changes. In the first form, death is often preceded by convulsions, and the post-mortem shows the brain distended with blood; in the latter, the difference is that of syncope from apoplexy. See Apoplexy.

HEMICRANIA. (See Lexicon.)

HEMIOPIA. (See Lexicon.)

HEMIPLEGIA. (See Lexicon.)

HEMRANÆSTHESIA. (See Lexicon.)

HEMORRHAGE. (See Hæmorrhage.)

HEMORRHOIDS. (See Lexicon.)

HEPATITIS is an inflammation of the liver, and is usually accompanied with a similar affection of the duodenum, stomach and gall-duct. It may end fatally, by a suspension of the functions of the liver, or result in an abscess of the same. (See Abscess.)

HEPATIZATION. (See Lexicon.)

HERPES. (See Lexicon.)

HICCUGH. (See Lexicon.)

HIP DISEASE (*Morbus Coxarius*, *Coxalgia*), inflammation of the hip joint, either acute or chronic. A disease of long duration attended with atrophy of the muscles over the hip, general weakness, emaciation, and suppuration at the joint, resulting in abscess and death from exhaustion or septicæmia. (See Amyloid disease.)

HOB-NAILED LIVER. See Gin liver.

HODGKIN'S DISEASE (*Pseudo-leukæmia*, is a disease in which the spleen and lymphatic glands become enlarged and adenoid, while, at the same time, there is a reduction in the number of red blood-corpuscles without an increase of the white.

In this disease the lymphatic glands of the body may become enlarged and undergo fibroid transformation, but do not suppurate. Death re-

sults from the mechanical pressure of these glands, or general debility. (See Leukæmia.)

*HOOPING COUGH. (See Pertussis.)

HYDATIDS. (See Lexicon.)

HYDROCEPHALUS. (Water in the head. Dropsy of the brain), is either a passive dropsical effusion within the cranium, or it may result from a chronic inflammatory condition of the arachnoid, or the lining membrane of the ventricles. Such cases are attended with emaciation of the body, general debility, and often an enormous enlargement of the head. Death results either from convulsions or general atrophy; in such cases it is desirable to pierce the softened bones of the skull with a trocar, and draw off the accumulated fluid, restoring the head to something of its normal appearance.

HYDROPHOBIA. (*Rabies Canina*.) According to Albutt, death from hydrophobia shows vascular congestion, serous infiltration, and granular degeneration of the the medulla oblongata, spinal cord and brain. In some cases œdema of the brain is also found. It is doubtful whether hydrophobia has ever been transferred to another person in the handling of a human body; but, bearing in mind Pasteur's theory on the subject, this should be done with great care.

HYDRO-PNEUMOTHORAX. (See Lexicon.)

HYPERÆMÆSTHESIA. (See Lexicon.)

HYPERÆSTHESIA. (See Lexicon.)

HYPERMETROPIA. (Hypertrophy.) (See Lexicon.)

HYPERTROPHY OF THE HEART. True hypertrophy consists in muscular thickness, as well as increase in size. (See Dilatation.) Hypertrophy of the heart is most frequently induced by valvular obstructions or regurgitation compelling an unusual effort to sustain the circulation. Bodies of those dying of this disease, are apt to be cyanosed about the face and in the body; care should be taken to drive the venous blood from the veins.

HYSTERIA. Is a morbid excitability and loss of control of the sympathetic nervous system. It is never a fatal disease, but may precede epilepsy, which see.

HYSTERICAL PARALYSIS. (Functional paralysis.) Is a symptom of hysteria, and like it without fatal results.

I.

ICHORHÆMIA. (See Septicæmia.)

ICHTHYSIS. (See Lexicon.)

ICTERUS. (See Jaundice.) (S.)

IMPETIGO. (See Lexicon.)

INCONTINENCE OF URINE. (See Lexicon.) (S.)

INFANTILE PARALYSIS. (See Poliomyelitis.)

INFLAMMATION OF THE BLADDER. (See Cystitis.)

INFLAMMATION OF THE BOWELS. (See Enteritis and Peritonitis.)

INFLAMMATION OF THE BRAIN. (See Encephalitis and Meningitis.)

INFLAMMATION OF THE BRONCHIA. (See Bronchitis.)

INFLAMMATION OF THE EAR. (See Otitis.)

INFLAMMATION OF THE ENDOCARDIUM. (See Endocarditis.)

INFLAMMATION OF THE KIDNEY. (See Nephritis.)

INFLAMMATION OF THE LARYNX. (See Laryngitis.)

INFLAMMATION OF THE LIVER. (See Hepatitis.)

INFLAMMATION OF THE LUNGS. (See Pneumonia.)

INFLAMMATION OF THE MOUTH. (See Stomatitis.)

INFLAMMATION OF THE PERITONEUM. (See Peritonitis.)

INFLAMMATION OF THE PLEURA. (See Pleurisy.)

INFLAMMATION OF THE STOMACH. (See Gastritis.)

INFLAMMATION OF THE TONSILS. (See Quinsy.)

INFLAMMATION OF THE VEINS. (See Phlebitis and Arteritis.)

INFLUENZA. (Epidemic Catarrh.) Inflammation of the nasal and bronchial mucous membrane, probably due to a specific organism. Not fatal.

INSANITY. (Mental Alienation, Unsound Mind, Madness.) A general term used to express all unsound mental conditions from melancholy to acute mania, which see.

INSOLATIO. (See Heatstroke.)

INSOMNIA, (S.) (See Lexicon.)

INTERCOSTAL NEURALGIA. Neuralgia of the intercostal nerves. (S.) (See Neuralgia.)

INTERMITTENT FEVER. (Periodic Fever, Ague, Chills and Fever, Paludal Fever.) A disease due to a specific poison, probably bacterial, arising in marshy grounds. It is characterized by periodic chill, fever and sweating. Where death results from protracted intermittent, it is due to anaemia and enlargement of the spleen and liver. Dropsy is not an infrequent complication of this disease. (See Dropsy.)

INTESTINAL OBSTRUCTION is due to a large variety of causes, such as cicatrices, tumors, cancers, intussusception, or angulation of the bowels. Whatever may be its cause, unless promptly relieved, death results from peritonitis or perforation. In all such cases rectal and abdominal injections should be used for the preservation of the body.

INTUSSUSCEPTION. (Invagination.) A drawing down of one part of the bowel into that below, like a glove finger may be drawn back into itself. Death, in these cases, results from obstruction of the bowels. (See above.)

IRITIS. (See Lexicon.)

ISCHURIA. (S.) (See Lexicon.)

*ITCH. (See Scabies.)

J,

*JAIL FEVER. (See Typhus Fever.)

JAUNDICE. (Icterus.) A symptom of many diseases of the liver; especially those in which there is an inflammation of the bile duct, or reabsorption of the bile pigments by the blood.

K,

KELOID (*Kelis Cheloidea*). (See Lexicon.)

KERATITIS. (See Lexicon.)

KIDNEY, AFFECTIONS OF. (See Nephritis and Bright's disease.)

KNOCK KNEES (*Genua valga*.) (See Lexicon.)

L,

LABIO-GLOSSO-PHARYNGEAL PARALYSIS is a paralysis of the lips, tongue, tongue, and pharynx (S).

LARDACEOUS LIVER (See Amyloid).

LARYNGISMUS STRIDULUS (*Laryngo-Spasmus*, Thymic asthma, Cerebral Croup, Child Crowing), a neurosis occurring chiefly in young children, manifesting itself by temporary closure of the glottis, which may cause death from asphyxia, which see.

LEPRA (*Psoriasis*). (See Lexicon.)

*LEPROSY (*Lepra Hebræorum*), is the leprosy described in the Bible. It is rarely, if ever, seen in this country, and is possibly contagious.

LEUCOCYTHÆMIA is that abnormal condition of the blood, in which its white corpuscles are largely increased in number. Death is the inevitable result of this disease by progressive anæmia. (See Anæmia.)

LEUCODERMA (*Chloasma album*, *Achroma*). (See Lexicon.)

LEUCORRHŒA (*Fluar Albus*). (See Lexicon.)

LEUKÆMIA. (See Leucocythæmia.)

LICHEN (*Papulæ siccæ*). (See Lexicon.)

LIGHTNING. Death from. In persons killed by lightning the internal viscera may be so lacerated and disorganized that the injection of the embalming fluid may be rendered impossible; nothing more can be done than local application and cavity injection.

LITHIASIS. (See Gravel.)

LIVER, AFFECTIONS OF. (See Acute Yellow Atrophy, Fatty Liver, and Amyloid Degeneration.)

LOCK JAW. (See Tetanus.)

LOCOMOTOR ATAXY (*Ataxic Paraplegia, Tabes Dorsalis*). A disease of the spinal cord, characterized by loss of co-ordination of the lower limbs. A disease of slow operation, in which the post-mortem shows atrophy and degeneration of the lower part of the spinal cord.

LUMBAGO (*Rheumatismus Dorsalis*, Rheumatism of the lumbar muscles). (See Rheumatism.)

LUPUS. (*Ulcus Tuberculosis*). (See Lexicon.)

M.

MACULA (*Plural æe*). (See Lexicon.)

MALARIAL FEVER. (See Intermittent.)

MANIA. (See Insanity.)

MANIA A POTU. (See Delirium Tremens.)

***MEASLES** (*Morbilli*). An extremely contagious disease, characterized by catarrh, bronchitis, and a rosy eruption upon the skin. Death, when it occurs, results from some complication, the most fatal of which are bronchitis and purpura, which see.

MELANCHOLIA. (S.) (See Lexicon.)

MELANÆMIA (S.) is that abnormal condition, sometimes following malarial fever, in which the coloring matter of the blood extravasates from it and is deposited in the liver and other organs.

MELASMA SUPRA-RENALIS (Addison's Disease). A systemic disease, characterized by a bronze-like coloration of the skin, general anæmia, and debility, and the only lesion found after death, being a lardaceous change of the supra-renal capsules. Similar changes undoubtedly occur in the gastric and intestinal tubercles.

***MEMBRANOUS CROUP** (True Croup, Fibrinous Laryngitis). Inflammation of the larynx, in which a fibrinous or diphtheritic membrane appears on the inner surface of the trachea, producing death by asphyxia or general poisoning. Bodies of those dying from this disease should be handled with the greatest care, for it is probably infectious; and the greatest care should be taken to thoroughly disinfect the cavities of the mouth and wind-pipe, where decomposition frequently begins before death.

MENINGITIS. An inflammation of the membranes of the brain, is usually associated with that of the brain substance, and may result either from direct injury, tubercle or specific causes. (See Cerebro-Spinal Meningitis.) The post-mortem appearances are those of congestion, opacity and thickening of the membranes of the brain, while the brain itself shows reddened points, and sometimes an excess of serum in its ventricles, with softening of the grey or white substances.

MENORRHAGIA. (See Lexicon.)

MENTAGRA. (Sycosis). (See Lexicon.)

MERCURIAL PALSY is that produced in those who are compelled to work for some time in the vapors of the metal. Death here results from exhaustion and diarrhœa.

METHOMANIA. (See Lexicon.)

MONOMANIA. (See Lexicon.)

***MORBILLI.** See Measles.)

MORBUS ADDISONII. (See Melasmus Supra-Renalis.)

MORBUS COXARIUS. (See Hip Disease.)

MUCOUS DISEASE is the name given by Dr. Eustace Smith, to a variety of disease chiefly met with in children, and characterized by excessive mucous secretion from all of the mucous surfaces. Where death results from this disease, it follows as a result of marasmus, from failure to assimilate food.

MUGUET. (See Thrush.)

***MUMPS.** (Parotitis Contagiosa, Cynanche Parotidea.) A specific inflammation of the parotid gland, which may also inflame from other causes. Contagious, but rarely, if ever fatal.

MYALGIA. (See Lexicon.)

MYELITIS (Inflammation of the Spinal Marrow) may show after death, diffuse redness and opacity of the membranes of the cord, effusion of the serum, adhesion, and even ulceration and gangrene. (See Cerebro-Spinal Meningitis.)

MYOCARDITIS is an inflammation of the muscular substance of the heart. (See Endocarditis.)

N.

NÆVUS. (Birth Mark.) (See Lexicon.)

NEPHRITIS. (See Bright's Disease.)

NEPHRITIS DESQUAMATIVA ACUTA. (Acute Bright's Disease.) An inflammation of the tubules of the kidney, accompanied with a casting off its lining cells (casts) the presence of albumen in the urine, and the occurrence of dropsy in the limbs and elsewhere. Death occurs from exhaustion or uræmia. (See Dropsy.)

NETTLE RASH. (See Urticaria.)

NEURALGIA. (See Lexicon.)

NIGHT TERRORS. A reflex neurosis, probably produced by irritation in the intestinal canal. May precede epilepsy, which see.

NITRE. Death from poisoning, like all other irritant poisoning is attended with intense congestion of the stomach, and sometimes even perforation, producing peritonitis, which see.

NITRIC ACID. Death from. In these cases the stomach contains a viscous, sanguinolent, yellow or greenish fluid, which ought to be got rid

of before injecting. The lungs will also be found highly congested, and the blood must therefore be emptied out. The acid, nitrate of mercury, and muriatic acid, produce about the same changes after death as those of nitric acid.

NURSING SORE MOUTH. (See Ulcerative Stomatitis and Anæmia.)

NUTMEG LIVER. (See Cirrhosis of the Liver.)

O.

OBSTRUCTION OF THE BOWELS may be due to tumors, angulation, intussusception or fecal accumulation. If not promptly relieved it is rapidly fatal. For precautions to be observed after death, see Intussusception.

ODONTALGIA. (See Lexicon.)

OEDEMA OF THE GLOTTIS may result directly from injury, or as a complication in laryngitis, typhoid, etc. It is exceedingly dangerous, often proving fatal from asphyxia, which see.

ESOPHAGUS, STRICTURE OF. May be functional or organic; in the latter case, death usually results from slow starvation. (See Marasmus.)

OIDIUM ALBICANS. (See Thrush.)

OINOMANIA. (See Lexicon.)

ONYCHIA. (See Lexicon.)

ONYXIS. (See Lexicon.)

OPHTHALMIA. (See Lexicon.)

OPIUM, POISONING FROM. The post-mortem appearance of persons who have been killed by the preparations of opium are negative. Intense congestion of the brain and lungs are spoken of by most authors, but they seem to depend chiefly on the way in which the patient dies, rather than on any specific action of the drug.

OPISTHOTONOS. (See Lexicon.)

ORTHOPNOEA. (S.) (See Lexicon.)

OTALGIA (S.) (See Lexicon.)

OTITIS. (See Lexicon.)

OVARIAN DROPSY (Ovarian tumor), is a cystic degeneration of the ovaries which, unless removed by the surgeon, produces death either from exhaustion, or from peritonitis caused by its rupture in the abdominal cavity. (See Peritonitis.)

OXALIC ACID, POISONING FROM. The autopsy shows generally the stomach to contain a dark, brown, mucous fluid, but in some cases of death from this poison there are no well marked lesions. There are no special difficulties in the preservation of such bodies.

P.

PARALYSIS. (Palsy.) A disease characterized by a loss, or great diminution of the power of the voluntary motion, affecting any part of

the body. In long continued paralysis the arteries upon the affected side may become diminished in caliber from inaction, and the body will require longer injection by the gravity method than is ordinarily required. A second injection is always advisable in such cases.

***PAROTITIS.** (Mumps.) An inflammation of the parotid and salivary glands, probably specific, and certainly in some cases contagious and epidemic.

PARTURITION. (See Puerperal fever and hemorrhage.)

PERICARDITIS. (See Heart, dropsy of.)

***PERITONITIS.** An inflammation of the serous membrane lining the cavity of the abdomen, and covering the viscera contained therein. An exceedingly fatal and at times apparently an infectious disease. After death there is found intense injection of the peritoneum, whose cavity contains a sero-purulent fluid, which is intensely poisonous, and may produce blood poisoning in its most virulent form. India rubber gloves should be used in handling such cases, as death may result from the slightest scratch, especially in cases of puerperal peritonitis. The abdomen is usually greatly distended with gas, which should be allowed to escape through a trocar or hollow needle, which may then be used to thoroughly disinfect the peritoneal cavity. The blood in these cases is thoroughly septic, and if possible should be drawn off before arterial injection is resorted to; and it should be remembered that such cases are among those which are exceedingly difficult to preserve.

PERTUSSIS. (See Lexicon.)

***PHAGEDAENA.** A magignant ulcer which spreads very rapidly, and may produce death from exhaustion or hemorrhage. (See Syphilis.)

PHARYNGITIS. Inflammation of the pharynx.

PHOSPHORUS, DEATH FROM POISONING. The post-mortem appearances vary with the length of time which lapses after death. If death takes place in a few hours, the only lesions are those produced by the direct action of the poison. The contents of the stomach, which must be evacuated, are often mixed with blood, and may have the peculiar smell of phosphorus. It is said that the mucous membrane of the stomach may emit a phosphorescent light in the dark. If death does not ensue until after several days, the lesions are more marked; the body is usually jaundiced, and there may be found a congestion of the liver, or there may be a small hemorrhage into the liver tissue.

PHLEBITIS. An inflammation of a vein or veins, characterized by a redness along its course, a hardness and cord-like line, tender to the touch.

PHLEGMASIA DOLENS. (Milk Leg, see Lexicon.)

PHTHISIS (Pulmonary Consumption, Tuberculosis.) The growth or exudation of a peculiar material in the form of a tubercle, which undergoes various changes in the lungs, associated with constitutional phenom-

ena of scrofula and progressive wasting. (See Tuberculosis and Acute Phthisis.) What is known as chronic phthisis is really a cirrhosis of the lung subsequent to chronic bronchitis, and may not show any cavities or suppuration after death, but simply condensation of lung tissue. In ordinary phthisis, however, there is a destruction of the lung tissue which leaves the capillaries exposed, and very prone to rupture under slight pressure, hence the frequency of purging from the mouth after arterial injection in such cases. This may be avoided by securely plugging the windpipe with antiseptic cotton pushed down into its place through the nostrils or mouth, or even by an incision through the neck. Direct injections into the lung tissue by the hollow needle are also advisable in these cases.

PILES. (See Hæmorrhoids.)

PITYRIASIS. A skin disease characterized by irregular patches of small, thin scales, which repeatedly form and separate, unattended with inflammation, and never collecting into crusts.

PLACENTA PREVIA is an abnormal attachment of the placenta over the os uteri. The hemorrhage is occasioned, first, by the slight dilatation of the cervix uteri, which takes place some weeks before delivery and detaches a portion of the placenta; and subsequently, by the still further dilatation which is affected during labor, during which death from hemorrhage very frequently takes place, but the preservation of such bodies presents no great difficulties.

PLEURISY (Pleuritis). An inflammation of the serous membrane that lines the cavity, and covers the viscera of the thorax, characterized by a febrile chill, followed by an acute, sharp pain in some part of the chest, respiratory actions being rapid but not complete, dry, short cough, hard, quick pulse.

PLEURODYNIA. A rheumatic pain, more or less acute in the muscles or fibrous textures of the chest, most commonly in the left side, in the infra-axillary and infra-mammary regions, increased by deep inspirations, cough, movements of trunk or arms, and by pressure on both ribs and intercostal spaces.

PNEUMONIA (Pneumonitis). An inflammation of the pulmonary tissue, which in its acute sthenic and uncomplicated form runs a definite course. It is expressed by severe febrile symptoms, which come on suddenly and in a few hours attain great intensity undergoing no less sudden abatement between the fifth and tenth days, in proportion to the severity of the disease, at which time the local lung lesions, the result of the inflammation are very intense, but are eventually removed.

PORRIGO. (See Tinea Favus.)

PROLAPSUS ANI. A failing down of the extremity of the rectum.

PROSTATITIS. An inflammation of the prostate gland.

PRURIGO. A papular eruption affecting the whole surface of the skin or confined to some particular part, accompanied with an intense itching.

PRUSSIC ACID, POISONING FROM. The skin is usually livid, and the muscles contracted; the stomach is congested, and the venous system unusually full of blood. The most characteristic condition, when this acid is present, is the odor of bitter almonds, exhaled from the stomach and tissues.

PSORIASIS. A condition of the skin, of a rough, scaly character, continuous, or in separate irregular patches.

***PUERPERAL FEVER.** A continued fever, communicated by contagion, occurring in connection with child birth, often associated with extensive local lesions, especially of the uterine system, peritonitis, effusions in the serous and synovial cavities, phlebitis, and diffuse suppuration. (See Peritonitis.)

PURPURA. A disease in which the blood or capillary vessels throughout the system, one or both are altered. Evident constitutional disturbances, manifested by disorder of digestive, assimilative, and excretory functions attended by languor and debility, not usually attended with fever. Small, round, red or deep purple colored spots are formed on the surface. Hemorrhages from mucous membranes are common.

***PYÆMIA.** A purulent state of the blood, in which pus globules are found floating among the proper blood disks. (See Septicæmia.)

PYROSIS. (Heart Burn.) A disease characterized by a pain in the stomach, with copious eructation of a watery insipid fluid. (S.)

R.

RABIES. (See Hydrophobia.)

RACHITIS. (See Lexicon.)

RECTITIS. Inflammation of the rectum.

***RELAPSING FEVER.** (Famine Fever, Recurrent Fever, Five Day Fever, Seven Day Fever, Bilious Remittent Fever, Synocha.) An infectious disease characterized by a recrudescence after a certain definite number of days of the symptoms of the fever, after their apparent subsidence, viz.: rigors, vomiting, enlarged liver, delirium, etc. The post-mortems in these cases show enlargement of the spleen and granulated and cre-nated red blood corpuscles. As the disease is supposed to be contagious the body should be treated as in all cases of contagious disease.

REMITTENT FEVER. (Walcheren Fever, Jungle Fever, Bilious Remittent, African Fever.) A fever closely resembling intermittent fever except that there is no entire intermittence of the fever but simply an abatement between its paroxysms. Examination after death shows an

enlarged and bronzed liver, the spleen also enlarged and congested and frequently congestion of other organs as complications.

RHEUMATISM. Two forms, the acute and chronic; the former is a formidable disease, owing to the suffering it causes, the intensity of the fever, and the damage it so frequently inflicts upon the heart. A superabundance of lactic acid in the system is the supposed cause. The latter form is sometimes a sequel of rheumatic fever, but generally a separate constitutional affection. Very common in old age. The fibrous textures around the joints, or fibrous envelopes of the nerves, or the aponeurotic sheaths of the muscles, or the fasciæ and tendons, or the periosteum, are the parts which suffer. Death from rheumatism usually results from heart complications (See Heart, Diseases of.)

RICKETS. (*Rachitis; Osteomalacia Infantum.*) A disease peculiar to childhood, as osteomalacia is to adults. The bones as they grow remain soft and flexible and bend under the weight of the body. Rarely fatal except from lung complications. (See Capillary Bronchitis.)

ROSEOLA (Rose Rash, False Measles, Epidemic Roseola). A non-contagious, inflammatory affection of the skin. One of the *Eryanthe-mata* and never fatal.

* **RUBEOLA** (Rötheln, Scarlatina Morbillosa, German Measles). A compound of measles and scarlatina.

RUPIA (*Ulcus Atonicum, Ecephlysis Rhyphia*). A non-contagious skin disease occurring in debilitated constitutions, and especially in systems contaminated with syphilis. (See Syphilis.)

S.

SAINT ANTHONY'S FIRE. The popular name for erysipelas.

* **SCABIES** (*Psora, Itch*). A contagious, troublesome skin disease, attended with great itching, which is increased by warmth, and is due to an animal parasite called the *Acarus Scabiei*, which can be readily communicated to the hands of the embalmer.

* **SCARLET FEVER** (*Scarlatina*). An infectious fever, characterized by scarlet efflorescence of skin and mucous membrane of fauces and tonsils; the efflorescence commencing about second day of fever, and declining about fifth. Often accompanied by inflammation of throat, and sometimes of submaxillary glands. The corpses of those dying with this disease are exceedingly contagious and should never be exposed in an open coffin, even after antiseptic injections. It is well to anoint these bodies with carbolated vaseline, as many supposed the contagion is carried by flying scales from the skin, and this may be prevented by the use of unguents. The post-mortem appearances of scarlet fever are those of septicæmia, and often with those of diphtheria added. (See Diphtheria.)

SCIATICA (Neuralgia Ischiadica, Ischialgia, Coxalgia). Acute pain in the sciatic nerve, due often to rheumatism.

SCLEREMA (Algide (Edema). A peculiar disease of new-born infants, consisting of partial or universal induration of subcutaneous areolar tissue, with serous effusion and great coldness of the body.

SCROFULA (Scrophula, Tabes, Glandularis, Struma, King's Evil). A constitutional disease attended with enlargement of the lymphatic glands which often suppurate. It is rarely directly fatal, but may lead to death by producing amyloid degeneration or tuberculosis, which see.

SCURVY (Scurbutus). A complex, morbid condition of the body caused by long-continued privation of fresh, succulent vegetables or fruit, or their preserved juices.

***SEPTICÆMIA** (Septæmia, Putrid Infection). Contamination of the blood—blood-poisoning—from the absorption of putrefying matters either from the body itself or by external inoculation. (See Wounds from Dissection.) Death from septicæmia results either from pyæmia, phlebetis or thrombosis, which see. Putrid decomposition really sets in before death in such cases, and hence such subjects are very difficult of preservation. The early removal of the septic blood and the most thorough arterial and cavity injections will be necessary in these cases, which often, notwithstanding the greatest care, prove disappointing.

SIMPLE CONTINUED FEVER (Febricula, Ephemera). A mild disease, having a variable duration of from one to ten days, and rarely if ever fatal.

***SMALL-POX** (Variola). A continued, infectious fever, attended with an eruption and due to absorption of a specific poison. The disease would probably become extinct, were vaccination universally and efficiently performed, and cremation resorted to immediately after death. It should be remembered that the corpse of one dying of small-pox probably remains for years a source of contagion, and no time should be lost in as quickly as possible disposing of these dead with all of the antiseptic precautions recommended by the various state boards of health.

SPANÆMIA. Thin or poor blood. (See Anæmia.)

SPERMATORRHEÆA (*Spermorrhœa, Gonorrhœa Vera, Profluvium Seminis, Pollution*). A deranged state of mental and bodily health, due to the too frequent escapes of the seminal fluid. Masturbation the most common cause.

SPINA BIFIDA (*Hydrorachitis, Cleft Spine*). A congenital deficiency of the posterior laminae and spinous process of one or more vertebræ, owing to which there is an undue distension of the membranes of cord with cerebro-spinal fluid.

SPINAL HÆMORRHAGE (*Myelorrhagia*). An apoplexy of the cord producing paralysis and death. (See Paralysis.)

STRANGULATION, DEATH FROM. (Hanging, etc.) In this instance the carotid arteries are often ruptured; the heart, the lungs, and the viscera are usually congested. In death from suffocation, the same symptoms except rupture of the arteries are present. As in case of *sunstroke*, decomposition sets in very rapidly, and requires an immediate check; the lungs will frequently be found congested, and should be dealt with as in pneumonia.

STRYCHNIA NUX VOMICA, ETC., POISONING FROM. In cases of poisoning from these, the cramping and contraction of the muscles relax after death, but the brain remains congested with blood and may produce discoloration of the face, unless especial means are taken to prevent this.

SULPHURIC ACID. POISONING BY. produces most of its effects upon the stomach which might be perforated, as also the adjoining viscera might be blackened and softened by the action of the acid. The blood is thickened, sirupy, acid, and the body may be partially preserved from putrefaction, as sulphuric acid retards the decomposition of the blood.

***SYPHILIS** (*Lues Venerea*, Venereal Diseases, Pox). Two forms, primary and constitutional. Primary occurs as a specific ulcer or chancre, the ulcer appearing on the part to which the virus has been directly applied. Constitutional, the result of indurated or infecting chancres. Many cases of chronic ill health are due to it; while it is often the cause of obscure diseases of the vital organs, in which gummy tumors are often found. It should be remembered that the ulcers of syphilis are exceedingly infectious, and that their poison may be transferred by means of instruments, clothing, etc. Probably the virus from these will not affect an unbroken skin, but the minutest break or prick with a syphilized needle may afford an entrance for the poison that, without treatment, will remain in the system for years. There can hardly be too great care taken in handling bodies that show sores about the genitals enlarged glands in the groins, or suspicious ulcers anywhere. It would be wise in all such cases to employ rubber gloves, *which should be destroyed after once using*, and all instruments and needles, etc., should either be replaced or most thoroughly disinfected with strong alcohol and boiled in an antiseptic solution. In case of suspected infection, immediately apply strong alcohol to the wound and consult some competent physician in regard to subsequent treatment.

T.

TETANUS (*Lock Jaw*). A disease in which there is tonic contraction of the voluntary muscles, usually beginning with those of the jaw. Death usually results from exhaustion, and there are no characteristic post-mortem lesions, although Dr. Allbutt reports having found soften-

ing of the cord in four cases; and erysipelas is not an unusual complication, especially in the lock jaw of new-born children.

THROMBOSIS. is caused by the formation of some foreign material in the circulation, and its being carried forward by the blood current until arrested by the small caliber of the vessel.

The word is usually used instead of embolism, but should be restricted to the formation of such a plug in the place where the arrested circulation takes place. Aseptic degeneration of these clots may cause septicæmia and death. (See Septicæmia.)

THRUSH. A disease of the mouth due to a growth on the mucous membrane of the *oidium albicans*.

THYRO-CARDICA. (See Exophthalmic Goitre.)

TIC DOULOUREUX. (F.) (See Lexicon.)

TONSILITIS. (See Lexicon.)

TOXÆMIA is literally blood-poisoning, and may result from contamination of the blood with poisons generated outside of the body, as small-pox, malaria, etc., or from absorption of those produced within the body. (See Leucomaines, Pyæmia, and Septicæmia.)

TRACHETIS. (See Croup.)

TRICHINA. (See Lexicon.)

TRISMUS NASCENTIUM (Infantile lock jaw.) (See Tetanus.)

TUBERCULOSIS. (Consumption) is defined by Hartshorne as a constitutional vice in the formation of blood whose plasma is defective in nutrition so that it forms, instead of healthy tissue, aborted blastema (tissues forming material) which accumulates as a deposit in one or many organs. This substance is called tubercle, and according to Rokitsansky, is deposited in the different organs in about the following order of frequency:

Lungs.	Spleen.
Intestines,	Kidneys,
Lymph-glands,	Liver,
Larynx,	Bones,
Serous membranes,	Uterus,
Brain,	Testicles.

Tubercle is distributed either in minute regularly formed masses, (miliary tubercle), or in irregular deposits which are known as infiltrated tubercle; and may be either semi-transparent and gray, or yellow, opaque, and cheesy. Tubercle may harden into a horny-like substance, or, more frequently, it softens and is thrown out by suppuration from the tissues in which it is deposited. Death consequently results from the exhaustion produced by this continued suppuration or from hemorrhage caused by rupture into the blood-vessels surrounding these deposits.

It should be remembered that the body of one dying from tubercle

is undergoing disintegration, especially in those parts in which the tubercle has been deposited, and which consequently require injection with the hollow needle, and the greatest care in using arterial injection in order that the blood-vessels in the already enfeebled tissues may not give way, but on the other hand the wasting character of the disease reduces the flesh to dry parchment, or nearly so, leaving but a very small portion of water in the system. Hence, as putrefaction is impossible in the absence of moisture, therefore the decomposition of such substances as remain ensues only by a process of slow combustion or oxidation due to the slow union of oxygen with these substances.

TUBERCULAR MENINGITIS is a meningitis due to a deposition of tubercle in the membranes of the brain. (See Meningitis.)

TYPHILITIS, is an inflammation of the cecum or surrounding tissues. The formation and internal rupture of an abscess is the usual cause of death in these cases. (See Abscess.)

***TYPHOID FEVER** (Nervous Fever, Continued Fever, Enteric Fever), is a continued fever due to a specific inflammation and infiltration with subsequent ulceration of the Peyer's patches or glands of the intestines.

Death results from exhaustion, perforation of the intestine, or internal hemorrhage. Special care should be taken in the disinfection of the passages from the bowels in typhoid fever; for while the disease itself is not contagious, the stools, if left to undergo fermentation, undoubtedly tend to reproduce the disease. Consequently great care should be taken in the disinfection of the entire alimentary canal after death; for in these cases there is an especial tendency to post-mortem purging and frothing.

TYPHO-MALARIAL FEVER is a disease in which the features of intermittent and typhoid fever are supposed to be commingled.

TYPHOID PNEUMONIA. (Asthenic Pneumonia, or Pneumonia Complicating Typhoid.) (See Pneumonia.)

***TYPHUS FEVER**. (Ship Fever, Camp Fever, Jail Fever.) A very fatal type of continued fever resembling in many of its features typhoid, but without its characteristic lesions in the intestine. The only abnormal thing shown in the post-mortem is that the blood is less coagulable and darker in color; and passive congestion of the various organs, as the liver, brain and lungs, especially the last, is generally found. (See Typhoid for treatment of the body after death.)

U.

ULCER OF THE STOMACH is not an infrequent cause of death in elderly people. Death results from slow starvation, perforation, and peritonitis or hemorrhage, which see.

ULCERATIVE SORE THROAT. (See Diphtheria.)

URÆMIA (S.) is retention in the blood of the material which should be excreted by the kidneys as urea. Uræmia is the usual cause of death in Bright's disease and dropsy, where life is terminated by vomiting, diarrhœa, convulsions or coma. (See Bright's Disease.)

URTICARIA. (See Lexicon).

UTERINE HEMORRHAGE. (See Hemorrhage.)

V.

VALVULAR DISEASE OF THE HEART is usually a symptom of other cardiac troubles, as pericarditis, calcareous degeneration, or from simple thickening or deposit of fibrinous or fatty material. The mitral, or aortic valve may be thus affected primarily, and the tricuspid, or pulmonary, secondarily. The result of this imperfect closure of the valves is to produce dilatation of the heart, and death from heart exhaustion or embolism, which see.

VARICELLA (Chicken-Pox). (See Lexicon.)

*VARIOLA (Small-Pox) may be discrete or confluent, modified, or varioloid, or malignant. Death usually ensues, in small-pox, from pneumonia or pyæmia, and it need scarcely here be noted that the most frequent cause of the spread of the disease is the shipping of the bodies of those dying of it from one point to another. Such corpses should be immediately buried with all possible antiseptic precautions, at the nearest possible point to the place of their death.

VERRUCA. (See Lexicon.)

VITILIGO. (See Lexicon.)

W.

WASTING PALSY (Cruveilhier's Disease) is a form of paralysis in which the muscles of a limb or the whole body, first lose their power and then gradually emaciate. No lesion has yet been found in the post-mortem examination.

WAXY LIVER. (See Amyloid.)

WHITLOW. (See Lexicon.)

WINTER FEVER. (See Typhoid Pneumonia.)

WRISTDROP. (See Lead Poisoning.)

WRITER'S CRAMP. (See Lexicon.)

WOUNDS of various kinds, knife, pistol, etc., are often so serious an obstacle to the proper performance of the embalmer's art that they deserve something in the way of practical hints at this point.

Dissecting Wounds. (See Poisons.)

Of the Head, may be carefully washed and filled with plaster of Paris, in thin paste, which soon hardens and fills the cavity, when injec-

tion can be resorted to as usual. This should be used warm if the body has previously become chilled. If head be entirely severed, inject separately and fasten to the trunk similarly treated.

Of the Heart, very materially interferes with arterial injection, if on the left side. In such cases it is recommended to use the common carotid and cavity injection.

Of the Limbs. A severed arm may be injected through its arteries and fastened to the body similarly prepared by injection through the carotid, the axillary of course being first ligated. A leg or foot crushed below the knee should have the ruptured arteries located and ligated by injection through the femoral. If necessary the mangled tissue may be removed and artificial members applied to the stumps.

Of the Throat. If in these cases the internal jugulars or carotids have been severed they should be ligated. The injecting may then be inserted into the carotid and injection done in this way, plaster of Paris afterward being used to close the wound and its edges sewed together over this.

Of the Trunk. The cavities should be freely opened, and by injection of the femoral the severed arteries discovered and ligated, and the cavities filled with antiseptic cotton, and the incision sewed together.

X.

XERODERMA. (See Lexicon.)

Y.

YELLOW ATROPHY OF THE LIVER. (See Acute Yellow Atrophy.)

*YELLOW FEVER is undoubtedly due to the introduction into the system of some specific contagious poison whose exact nature is as yet unknown. It is a very fatal disease, the autopsy showing congestion of the brain, inflammation of the stomach, and the liver dry, pale, yellow, anæmic, although it is occasionally found engorged, as are also the kidneys. According to Hartshorne, the material cause of yellow fever is never generated or multiplied in the bodies of those having had the disease, which may be taken anywhere without fear of communicating it; but it may possibly be transmitted by clothing, bedding or merchandise, which can, however, be thoroughly disinfected by superheated steam.

III.

TABLE OF POISONS WITH THEIR SMALLEST FATAL DOSES AND A LIST OF THE ANTIDOTES WHICH HAVE BEEN USED FOR EACH MOST SUCCESSFULLY.

A poison, according to Guy's definition is any substance—solid, liquid or gaseous—which when applied to the body outwardly, or in any way introduced into it, without acting mechanically but by its own inherent qualities, can destroy life or injure health.

Poisons are usually divided into three groups, viz.: Irritants, Narcotics and Narcotico-Irritants, but the division adopted here is that of Tardieu who divides poisons into eight groups, as follows: Corrosive, Choleriform, Irritant, Anæsthetic, Narcotic, Heart, Respiratory, and Cerebro-spinal poisons. Where it is necessary in the following list to economize space, poisons will be assigned to these various groups by the use simply of initial letters for this purpose.

Irritant poisons give rise to pain in the stomach and bowels, sickness, and purging with tenesmus. The evacuations are often tinged with blood, the pulse is feeble and irregular, and the skin cold. Many of the substances of this class also corrode the tissues with which they come in contact, and hence they produce a severe burning sensation in the mouth, œsophagus, and stomach. The degree of chemical action produced will of course vary in proportion to the amount of water with which the noxious agent may be diluted. They cause death by inducing collapse, or convulsions; or by exciting severe inflammation; or, after a variable interval, by leading to stricture of the œsophagus. The diseases which most resemble the action of the irritants, are malignant cholera, severe diarrhœa, colic, gastritis, enteritis, rupture of the stomach or intestines, and obstruction of the bowels.

Narcotics act on the brain and spinal cord, inducing headache, drowsiness, giddiness, stupor, and insensibility. Frequently there are convulsions, and sometimes paralysis. There is very seldom vomiting or diarrhœa. The symptoms of apoplexy, epilepsy, and uræmia bear a resemblance to those caused by this class.

Narcotico-Irritants produce great thirst, pain in the throat and stomach, vomiting and purging, delirium with spectral illusions and rarely convulsions. Sometimes there is tetanus, sometimes coma or syncope. Diseases of the brain and spinal cord are often very insidious

in their progress, and hence may suddenly give rise to suspicious symptoms. The history, mode of attack, etc., will generally negative any suspicion of poisoning.

For a fuller description of the post-mortem appearance after death from special poisons see diseases and their pathological changes.

A.

ACETIC ACID. Corrosive and irritant. Two cases with fatal results from injection into suppurating wounds.

Antidotes: Magnesia, chalk or carbonate of soda.

ACID ARSENIC. Fatal dose two and one-half grains. I. & C.

Antidotes: Hydrated peroxide of iron, dialyzed iron and demulcent drinks.

ACID ARSENIOS. (White Arsenic.) Choleric form Poison. Fatal dose two grains.

Antidotes: Calcined magnesia, hydrated peroxide of iron, dialyzed iron and demulcent drinks.

CARBONIC ACID GAS. Narcotic poison when inhaled in sufficient quantity.

Antidotes: Fresh air, stimulants, transfusion and artificial respiration.

CITRIC ACID. No fatal cases recorded. Irritant.

Antidotes: Magnesia, chalk, carbonate of soda or potassa.

HYDROCYANIC ACID. Fatal dose, one grain. Narcotic.

Antidotes: Ammonia, chlorine in solution, carbonate of potassa in solution followed by sulphate of iron in solution.

MURIATIC ACID. Corrosive and irritant. Fatal dose, four drachms.

Antidotes: Carbonate of soda, carbonate of lime or potassa, carbonate of magnesia.

NITRIC ACID. Corrosive and irritant. Fatal dose, two drachms.

Antidotes: Carbonate of lime, magnesia, chalk, or carbonate of soda.

OXALIC ACID. Narcotico-irritant. Fatal dose, one-half ounce.

Antidotes: Carbonate of magnesia, lime, plaster from the ceiling, but not any of the other alkalies.

PHOSPHORIC ACID. Irritant poison. Fatal dose, see phosphorus.

Antidotes: Ammonia, chlorinated water, magnesia, or even large draughts of water.

PRUSSIC ACID. See Hydrocyanic acid.

SULPHURIC ACID. Corrosive poison. Fatal dose, one drachm.

Antidotes: Magnesia, or its carbonate, carbonate of lime, chalk, carbonate of soda, whiting, milk, or oil.

SULPHUROUS ACID. Narcotico-irritant. Fatal by asphyxia.

Antidotes: Cautious inhalation of ammonia gas, tartaric acid, carbonate of lime, carbonate of magnesia, plaster from the ceiling.

ACETATE OF COPPER. Irritant. Fatal dose, one-half ounce.

Antidotes: Albumen or white of eggs, iron and milk.

ACETATE OF LEAD. Irritant. Fatal only in large doses, when no vomiting takes place.

Antidotes: Sulphate of magnesia, sulphate of soda, phosphate of soda, iodide of potassium albumen, milk.

ACETATE OF ZINC. Irritant.

Antidotes: Sulphate of zinc, carbonate of soda, tannic acid, albumen, milk.

ACETATE OF MORPHIA. Narcotic poison. Fatal dose, half grain.

Antidotes: Infusion of galls, tannic acid, green tea, coffee, stimulants, dash of cold water.

ACONITE. Aconitum Napellus. Fatal dose, four grains extract. N. P.

Antidotes: Tannic acid, green tea, chlorine and iodine well diluted.

ACONITA. Aconitina. Fatal dose, one-tenth grain. N. P.

Same antidotes as for aconite.

AETHUSIA CYNAPIUM. Common fool's parsley. (N. I. P.) About six ounces fatal dose.

Antidotes: Emetics.

AETHER SULPHURICUM. Sulphuris ether (A.) Fatal only by inhalation.

Antidotes: Ammonia by inhalation, fresh air, artificial respiration.

AESULUS OHIOENSIS. Buckeye. (C—S. N.) Fatal dose, unknown.

Antidotes: Ammonia, alcohol.

ALCOHOL. Anaesthetic. Fatal dose, uncertain, usually from liquors.

Antidotes: Acetate of ammonia, common table salt.

ALUMINATE OF POTASSA. Alum. (I. P.) Fatal dose, two grains.

Antidotes: Carbonate of soda or ammonia.

ALMONDS, BITTER. Tetanic. Fatal dose, 15 minims oil.

Antidotes: Inhalations of ammonia, chlorine, chloroform.

AMANITA-MUSCARIA. Truffles. See Muscarine.

AMMONIA. Irritant poison. Fatal dose, half ounce.

Antidotes: Vinegar, lemon juice, demulcent drinks.

AMMONIA. AQUA. Hartshorn. Irritant poison. Fatal dose, half ounce.

Antidotes: Vinegar, lemon juice and demulcents.

AMMONIACAL VAPOR. Irritant poison.

Antidotes: Vapor of vinegar, steam.

AMMONIA ARSENIAS. Arseniate of ammonia. Fatal dose, three grains.

Antidotes: Hydrated peroxide of iron, hydrated magnesia, oil mixed with lime water, milk, etc.

AMMONIA ARSENIS. Arsenite of ammonia. (Ch. P.)

Antidotes: See arseniate of ammonia.

AMMONIA LIQUOR. See ammonia, aqua.

AMMONIA HYDROCHLORATE. Muriate of ammonia. Fatal dose, half ounce. (I. P.)

Antidotes: Fixed oils, vinegar and lemon juice.

AMMONIÆ CARBONAS. Carbonate of ammonia. (I. P.) Fatal dose, half ounce.

Antidotes: Fixed oils, vinegar and lemon juice.

AMYGDALIS COMMUNIS. Bitter almond. Fatal dose, 15 grains oil. (C—S. P.)

Antidotes: Ammonia, chlorine, tannic acid and charcoal.

AMYGDALIA PERSICA. Peach leaves. Action like bitter almonds.

Antidotes: Ammonia, chlorine, tannic acid and charcoal.

ANAGALLIS ARVENSIS. Meadow pimpernel. Fatal dose, unknown.

Antidotes: Charcoal, tannic acid and green tea.

ANEMONE PULSATILLA. Wind flower. (I. P.) Fatal dose, unknown.

Antidotes: Charcoal, emetics.

ANIMAL POISONS. Balistes Monoceros, Old Wife. Cancer Astacus, Crawfish. Cancer Ruricolus, Land Crab. Clupea Thyrssa, Yellow-billed Sprat. Coracinus Fuscus Major, Gray Snapper. Coracinus Minor, Hyne. Coryphæna Splendens, Dolphin. Mornmyra, Blue Parrot-fish. Murena Major, Conger Eel. Mytilus Edulis, Mussel. Ostracion Globellum, Smooth Bottle-fish. Perca Major, Barracuda. Perca Venenosa, Grooper. Perca Venenata, Rock-fish. Physalia, Portuguese Man-of-War. Scomber Coruleus, Spanish Mackerel. Scomber Maximus, King-fish. Scomber Thynnus, Bonnetta. Sparus Chrysops, Porgée. Tetrodon Sceleratus, Tunny. Tetrodon Ocellatus, Blower.

An emetic should be speedily given of ground mustard or sulphate of zinc; tickling the throat with the finger; large draughts of warm water; after full vomiting, an active purgative should be given to remove any of the noxious matter from the intestines. Vinegar and water may be drunk after the above remedies have operated; and the body may be sponged with the same. Water made very sweet with sugar, to which ether may be added, may be drunk freely as a corrective. A solution of chlorate of potash, or of alkali, the latter weak, may be given to obviate the effects of the poison. If spasm ensue after evacu-

ations, laudanum in considerable doses is necessary. If inflammation should occur, combat in the usual way.

ANTIMONIAL VAPOR. Choleriform poison. Fatal dose uncertain.

Antidotes: Vapor of vinegar and ammonia.

ANTIMONII CHLORIDUM. Chloride of antimony. Fatal dose, two ounces. (I. P.)

Antidotes: Tannic acid, green tea, astringent infusions and alkalies.

ANTIMONII OXIDUM. Oxide of antimony. Irritant poison. Fatal dose, uncertain.

Antidotes: Tannic acid, green tea, astringent infusions and charcoal.

ANTIMONII ET POTASSÆ TARTRAS. Tartar emetic. Fatal dose, two grains.

Antidotes: Tannic acid, astringent infusions, yellow bark and green tea.

ANTIMONII VINUM. Wine of antimony. Contains two grains of tartar emetic to the ounce. (I. P.)

Antidotes: Astringent infusions and green tea.

APIS MELLIFICA. Honey Bee. Local poisoning from sting.

Antidotes: Solution of ammonia, or common salt, locally.

APOCYNUM ANDROSAEMIFOLIUM. Dog's Bane. Heart poison. Fatal Dose, unknown.

Antidote: Charcoal.

ARGENTI NITRAS. Nitrate of Silver. (I.) Fatal in small quantities.

Antidotes: Common table salt, albumen.

AROMATIC SULPHURIC ACID. Elixir Vitriol. (See Sulphuric Acid.)

Antidotes: Magnesia, lime, chalk, soda.

ARSENICUM. Arsenic. (I. P.) Fatal dose 1 grain.

Antidotes: Hydrated peroxide of iron, hydrated magnesia.

ARSENIAS AMMONIÆ. Arseniate of ammonia. (I. P.) Fatal dose, three grains.

Antidotes: Hydrated peroxide of iron, hydrated magnesia

ARSENIAS CUPRI. Arseniate of copper. (I. P.) Fatal dose two-thirds grain.

Antidotes: Hydrated ferric oxide, hydrate of magnesia.

ARSENIAS POTASSÆ. Arseniate of Potassa. (I. P.) Fatal dose three grains.

Antidotes: Ferric hydrate, magnesia hydrate, dialyzed iron.

ARSENIAS SODÆ. Arseniate of Soda. (I. P.) Fatal dose three grains.

Antidotes are the same as for arseniate of potassa.

ARSENIS AMMONIÆ. Arsenite of Ammonia. (I. P.) Fatal dose, three grains.

Antidotes are the same as for arseniate of potassa.

ARSENIS CUPRI. Arsenite of copper. (I. P.) Fatal dose, three grains.

Antidotes are the same as for arseniate of potassa.

ARSENIS POTASSÆ. Arsenite of Potassa. (I. P.) Fatal dose, three grains.

Antidotes are the same as for the arseniate of potassa.

ARSENICI OXIDUM ALBUM. White oxide of Arsenic. (C. P.) Fatal dose, two grains.

Antidotes are the same as for arseniate of potassa.

ARSENICI OXIDUM NIGRUM. Black oxide of arsenic. (See Arsenicum.)

Antidotes are the same as for arseniate of potassa.

ARSENICI SULPHURETUM FLAVUM. Yellow Sulphide of Arsenic. (I. P.) Fatal dose, sixty grains.

Antidotes are the same as for the arseniate of potassa.

ARSENICI SULPHURETUM RUBRUM. Red Sulphide of Arsenic. Fatal dose, same as yellow sulphide.

Antidotes are the same as for the arseniate of potassa.

ARUM MACULATUM. Wake Robin. (N. I. P.) Fatal dose, two drachms of juice.

Antidote: Charcoal, melted butter.

ATROPA BELLADONNA. Deadly Night-shade. (N. P.) Fatal dose, one drachm extract.

Antidotes: Bromine, chlorine, iodine, stimulants, lime water and vinegar.

ATROPIA. Alkaloid of above. (N. P.) Fatal dose, two grains.

Antidotes same as above.

AURI ET SODII CHLORIDUM. Chloride of Gold and Sodium. Fatal dose, six grains.

Antidotes: Ferrous sulphate and mucilage.

B.

BARII CHLORIDUM. Chloride of Barium. (I. P.) Fatal dose, three drachms.

Antidotes: Sulphate of magnesia, sulphate of soda.

BARYTA. Barytes. (I. P.) Fatal dose, one drachm.

Antidotes: Sulphuric acid (dilute), sulphate of magnesia, sulphate of soda.

BARYTÆ CARBONAS. Carbonate of Baryta. (I. P.) Fatal dose, one drachm.

Antidotes same as above.

BARYTÆ MURIAS. Muriate of Barytes. Same as Barii chloridum.

Antidotes: Sulphate of soda, sulphate of magnesia, dilute sulphuric acid.

BARYTE NITRAS. Nitrate of baryta. Action same as other salts of baryta.

BELLADONNA ATROPA. Deadly Nightshade. (N. P.) Fatal dose one drachm extract.

Antidotes: Bromine, chloride, iodine. Emetic of sulphate of zinc.

BICHROMATE OF POTASH. Irritant poison. Fatal dose 10 grains.

Antidotes: Carbonate of potassa, carbonate of soda, emetics.

C.

CALOMEL. Irritant. Fatal dose 20 grains.

Antidotes: Gluten, iodine, white of egg.

CALTHA PALUSTRIS. Marsh Marigold. Chloroform.

Antidotes: Emetics and charcoal.

CALX. Quicklime. Corrosive. Fatal dose indefinite.

Antidotes: Mineral soda water, effervescing draught

CAMPHORA. Camphor. (C—S. P.) Fatal dose, one ounce.

Antidotes: Emetics, chloral.

CANTHARIS VESICATORIA. Spanish Fly. (I. P.) Fatal dose, 24 grains.

Antidotes: Whisky, ammonia.

CARBONIC ACID GAS. See Acidum Carbonicum. Inhalation fatal.

Antidotes: Fresh air, oxygen, transfusion.

CARBURETTED HYDROGEN GAS. Narcotic. Inhalation fatal.

Antidotes: Chlorine gas inhaled cautiously.

CHENOPODIUM MURALE. Wormseed. Narcotico-irritant.

Antidotes: Emetics.

CHEESE. (Spoiled.) See Tyrotoxicon. Fatal dose, unknown.

Antidotes: Charcoal and emetics.

CHLORINE. Irritant. By inhalation.

Antidotes: Ammonia, ether by inhalation.

CHLORHYDRIC ACID. Muriatic Acid. Fatal dose, one drachm. (I. P.)

Antidotes: Ammonia, weak alkalies

CHLOROFORM. Anæsthetic. Fatal by inhalation.

Antidotes: Ammonia by inhalation. Galvanic Shocks, artificial respiration.

CICUTA VEROSA. Water Hemlock. Fatal dose, $\frac{1}{2}$ root. (C—S. P.)

Antidotes: Emetics, chloral.

CINNABAR VERMILION. Persulphuret of Mercury. Irritant Poison

Antidotes: Charcoal, albumen, gluten, mucilage.

COCULUS INDICUS. Fish-berries. See Picrotoxin.

Antidotes: Bromine, chlorine, iodine.

COLCHICUM AUTUMNALE. Meadow Saffron. See colchicina. (Ch. P.)

COLCHINA Active principal of Colchicum. Fatal dose, $\frac{1}{2}$ grain.

CODEIA. See opium.

Antidotes: Infusion of galls, coffee, tannic acid.

COLUBEA BERUS. Black Viper. See appendix to poisons.

Antidotes: Alcohol, ammonia, asclepius verticulata. Anemone, cylindrea.

CONIUM MACULATUM. Hemlock. Fatal dose, 10 drachms of extract. Narcotic.

Antidotes: Bromine, chlorine, iodine, tannic acid.

CONINE, CONIL. Conine. alkaloid of conium mac. One drop very dangerous.

Antidotes: Galls, vinegar.

CONVOLVULUS JALAPA. Jalap. Irritant. Fatal dose, 8 drachms.

Antidotes: Bromine, chlorine, iodine.

CONVOLVULUS SCAMMONII. Scammony.

Antidotes:

CORROSIVE SUBLIMATE. (Ch. P.) See Hyd. chlorisum corrosivum.

Antidotes: Albumen, gluten, gold-dust, iron-filings.

CRABS. Irritant. See appendix to poisons.

Antidotes: Milk, mucilage.

CREOSOTUM. Creasote. Fatal dose, 3 drachms. Narcotic irritant.

Antidotes: Albumen, sugar, iron, milk.

CROTALUS HORRIDUS. Rattle Snake. See appendix to poisons.

Antidotes: Alcohol, chichona, ammonia, scutillaria and asclepias verticulata (?)

CROTON TIGLIUM. Croton oil. (I. P.) Fatal dose, $\frac{1}{2}$ drachm.

Antidotes: Demulcents and opiates.

CUCUMIS COLOCYNTHUS. Colocynth. (I. P.) See Colocynthine.

Antidotes: Bromine, chlorine, iodine.

CURARE. Arrow poison. (A.) Fatal in smallest quantities.

Antidotes: Common salt, sugar, nux vomica.

CUPRI ACETAS. Acetate of copper. (I. R.) Fatal dose, one ounce.

Antidotes: Albumen, sugar, iron, milk.

CUPRI AMMONIATUM. Ammoniated Copper. (I. R.) Fatal dose, one ounce.

Antidotes: Iron, albumen and milk.

CUPRI ARSENIS. Arsenite of copper. Paris green. See Arsenates.

Antidotes: Ferric hydrate, dialyzed iron.

CUPRI CARBONAS. Carbonate of Copper. (I. P.) Fatal dose, one ounce.

Antidotes: Albumen, iron filings.

CUPRI OXIDUM. Oxide of copper. (I. P.) Fatal dose, one ounce.

Antidotes: Albumen, iron filings.

CUPRI SUBACETAS. Acetate of copper, verdigris. (I. P.) Fatal dose, one ounce.

Antidotes: Albumen, ferrocyanide of potassa, milk.

CUPRI SULPHAS. Sulphate of Copper. (I. P.) Fatal dose, one ounce.

Antidotes: Albumen, iron filings, ferrocyanide of potassa.

CYANIDE OF POTASSIUM. Cyanide of Potassa. (I. P.) Fatal dose, three grains

Antidotes: Sulphate of iron in solution.

CYTISUS LABUNUM. Laburnum. (N. P.) 20-60 grs of the bark.*

Antidotes: Chlorine, bromine, iodine.

D.

DAPHNE MEZEREUM. Mezereon. Berries poisonous. Fatal dose, uncertain.

Antidote: Charcoal.

DATURIA STRAMONIUM. Thorn apple. (N. P.) Fatal dose, uncertain.

Antidote: Bromine, chlorine, iodine, vinegar, lime juice.

DELPHINIUM STAPHISAGRIA. Stavesacre. (B. P.) Fatal dose, one ounce.

Antidote: Charcoal.

DIGITALIS PURPUREA. Foxglove. (H. P.) Fatal dose, twenty grains.

Antidote: Infusion of yellow bark, stimulants, galls tannic acid, green tea, emetics.

DIGITALINE. Alkaloid of above. Heart poison. Fatal dose, $\frac{1}{2}$ grain.

Antidote: Same as above.

E.

EELS. See Animal Poisons. I. P.

Antidotes: Charcoal, emetics, etc.,

ELATERIUM MOMORDICA. Squirting cucumber. (Ch. P.) Fatal dose, few grains.

Antidotes: Bromine chlorine, iodine.

F.

FERRI CHLORIDUM. Chloride of Iron. (I. P.) Fatal only in large doses.

Antidotes: Carbonate of soda, magnesia, mucilage.

FERRI SESQUI-CHLORIDUM. Muriated Tincture of Iron. Same as above.

Antidote: Carbonate of soda.

FERRI SULPHAS. Sulphate of Iron. (I. P.) Fatal only in large doses.

Antidotes: Carbonate of soda, magnesia, mucilage.

FUSEL OIL. Heart Poison. Few drops fatal to lower animals.

Antidote: Emetic.

FUNGI. See Mushrooms.

Antidotes: Tannin and salt.

G.

GAULTHERIA PROCUMBENS, OIL OF. Oil of Wintergreen. Heart poison. Fatal dose, one ounce.

Antidote:

GELSEMIUM SEMPERVIRENS. Yellow Jessamine. (I. P.) Fatal dose, three teaspoonfuls of extract.

Antidotes: Ammonia, charcoal.

H.

HELEBORUS ALBUM. White Hellebore. Fatal dose, one-half drachm extract.

Antidote: Charcoal.

HORNET STING. Local inflammation.

Antidotes: Ammonia or dilute carbonic acid.

HYDROCHLORIC ACID. Muratic Acid. (C. P.) Fatal dose, one drachm.

Antidotes: Ammonia and dilute alkalis.

HYOSCYAMUS NIGER. Black Henbane. (N. P.) Seed and root poison.

Antidotes: Bromine, chlorine, iodine, vinegar and ammonia.

HYOSCYAMIA. Alkaloid of Above. (N. P.) Fatal dose, one grain.

Antidotes: Same above.

HYDRARGYRUM. Mercury. Irritant poison. Fatal only in large doses.

Antidotes: Albumen, gluten, iodine.

HYDRAGYRI CHLORIDUM COROSIVUM. Corrosive Sublimate. (Ch. P.) Fatal dose, three grains.

Antidotes: Albumen, gluten, iodine.

HYDRARGYRI CYANURETUM. Cyanuret of Mercury. (C—S. P.) Fatal dose, ten grains.

Antidotes. Albumen, gluten.

HYDRARGYRI NITRAS. Nitrate of Mercury. (I. P.) Fatal dose, one-half ounce.

Antidotes: Albumen, gluten.

HYDRARGYRI OXIDUM RUBUM. Red Precipitate. (I. P.) Fatal in large doses.

Antidotes: Albumen, gluten.

HYDRARGYRI SULPHAS FLAVUM. Yellow Sulphate of Mercury. (I. P.) Fatal dose, uncertain.

Antidotes: Albumen, gluten.

HYDRARGYRUM AMMONATUM. Ammoniated Mercury. (I. P.) Fatal in large doses.

Antidotes: Albumen, gluten.

HYDROCYANIC ACID. Prussic Acid (C. S. P.) Fatal dose, one grain.

Antidotes: Dilute chlorine gas, ammonia.

I.

IODINE. (Irritant Poison.) Fatal dose, three grains.

Antidotes: Gluten, wheat flour, starch.

IODIDE OF POTASSIUM. (Irritant.) Fatal dose, ten grains (??.)

Antidotes: Gluten, wheat flour, starch.

IPECACUANHA. (Irritant Poison.) Dangerous in large doses.

Antidotes: Bromine, chlorine, iodine.

IRON AND ITS SALTS. (Irritant Poison.) Fatal only in large doses.

Antidotes: Carbonate of soda, carbonate of magnesia.

J.

JATROPHA CURCAS. Indian nut. (N. P.) Fatal even when locally applied.

Antidotes: Charcoal and stimulants.

JATROPA MANIHOT. Cassada. (N. P.) Fatal dose, thirty grains.

Antidote: Charcoal.

JUNIPERIS SABINA OLEUM. Oil of Savin. (C. S. P.) Fatal dose, one ounce.

Antidotes: None reliable.

K.

KALMIA LATERIFOLIA. Mountain Laurel. (N. I.) Dose, uncertain.

Antidotes: Emetics and stimulants.

L.

LACTIS. Milk, spoiled. (See Tyrotoxicon.)

LAURUS CAMPHORA. Camphor. (C. S. P.) Fatal in large doses, one ounce.

Antidotes: Chlorine and stimulants.

LAUREL MOUNTAIN. Calico bush. (See *Kalinia Laterifolia*.)

LAUREL WATER. (C. S. Poison.) Fatal dose, one ounce.

Antidotes: Inhalations of ammonia, chloroform.

LOBELIA INFLATA. Indian Tobacco. Fatal dose, one drachm. (H. P.)

Antidotes: Stimulants.

LYTTA VESICATORIA. Spanish Fly. Fatal dose, two grains. (Irritant Poison.)

Antidotes: Emetics, opium.

LEAD AND ITS SALTS. Fatal in large doses. (See salts.)

Antidotes: Dilute sulphuric acid, iodide of potassium, sulphate of soda, sulphate of magnesia.

M.

MACKERAL. (Spoiled). (See Propylamine.) (H. and I. P.)

Antidotes: Charcoal.

MILK. (Spoiled.) (See Tyrotoxicon.)

Antidotes: Charcoal.

MERCURY AND ITS SALTS. Fatal in large doses. (I. P.)

Antidotes: Albumen, gluten, iodine, charcoal, sulphate of soda.

MORPHIA AND ITS SALTS. Fatal dose, one grain. Narcotic poison.

Antidotes: Astringents, charcoal, coffee, ammonia.

MOMORDICA ELATERIUM. Squirting Cucumber. (N. I. P.) Fatal dose, a few grains.

Antidotes: Bromine, chlorine, iodine.

MORMYRA. Blue Parot Fish. (See animal poisons.) (I. P.)

Antidotes: Charcoal, emetics.

MUSCARINE. Poisonous alkaloid of mushrooms. (C. S. P.)

MUSHROOMS. (See Muscarine.) Fatal dose, uncertain.

Antidotes: Charcoal, salt and emetics.

MURAENA MAJOR. Conger Eel. (I. P.) (See animal poisons.)

Antidotes: Charcoal.

MURIATIC ACID GAS. (Irritant Poison.) Inhalation dangerous.

Antidotes: Inhalation of ammonia *cautiously*.

MYTILUS EDULIS. Mussel. (D. P.) (See animal poison.)

Antidotes: Charcoal.

NARCISSIS PSEUDO-NARCISSUS. Daffodil. Fatal only to lower animals.

Antidotes: Charcoal.

N.

NARCOTINA. Alkaloid of Opium. (N. P.) Fatal dose, uncertain.

Antidotes: Astringents, coffee, ammonia.

NERIUM OLEANDER. Common Oleander.

Antidotes: Charcoal.

NITRIC OXIDE. (Irritant Poison.) Fatal only by inhalation.

Antidotes: Fresh air and transfusion.

NICOTINA TABACUM. Tobacco. (H. P.) Fatal dose, uncertain.

Antidotes: Camphor stimulants.

NITROUS ACID (Irritant Poison.) Fatal dose, two drachms.

Antidotes: Ammonia and diluted alkalies.

O.

OENANTHE CROCAT. Hemlock Dropwort. Leaves and roots very poisonous.

Antidotes: Infusion of galls, emetics, castor oil.

OESTRUS BOVIS. Gad Fly. Local irritant only.

Antidotes: Solution of ammonia, or dilute carbolic acid locally.

OLEUM CORNI CERVI EMPYREUMATICUM. Oil of Hartshorn. Dip-pel's animal oil. (Irritant Poison.) Fatal dose, teaspoonful.

Antidotes: Fixed oils, vinegar, lemon juice.

OLEUM PICIS LIQUIDA. Oil of Tar. See Creasote.

OLEUM TEREBINTHINA. Oil of Turpentine. (N. A. P.) Fatal dose, several ounces.

Antidotes: Ammonia stimulants.

OPIUM. Crude Opium. (N. P.) Fatal dose, four grains.

Antidotes: Infusion of galls, astringents, coffee, magnesia, chlorine, charcoal, iodine, bromine.

OSMIUM. Very poisonous in small doses to lower animals, especially in the form of vapor.

OXALIC ACID. Acid of Wood Sorrel. (N. I. P.) Fatal dose, one-half ounce.

Antidotes: Chalk, lime, plaster from the ceiling.

OSTRACION GLOBELLUM. Smooth Bottle Fish. See animal poisons.

Antidotes: Charcoal and emetics.

OYSTERS. (I. P.) (See animal poisons.)

Antidotes: Milk, mucilage, ether.

OURARA. Indian War Poison. (C. S. P.) Fatal in the smallest quantities.

Antidotes: Iodine, iodide of potassium.

P.

PAPAVR SOMNIFERUM. Popy. (N. P.) (See Opium for fatal dose.)

Antidotes: Infusion of galls astringents, coffee, albumen, charcoal.

PARSNIP, WILD. (C. S. P.) Fatal dose, one ounce root.

Antidotes: Charcoal and emetics.

PERCA MAJOR. Barracuda. (See animal poisons.)

Antidotes: Charcoal and emetics.

PERCA VENENATA. Rock-fish. (See animal poisons.)

Antidotes: Charcoal, ammonia.

PHOSPHOROUS. (Irritant Poisons.) Fatal dose, one and one-half grains.

Antidotes: Magnesia, mucilage, lac magnesia.

PHYSALIA. Portugese Man-of-War. Local irritant and poison.

Antidote: Charcoal.

PHYTOLACCA DECANDRA. Poke. (N. I. P.) Fatal doses, uncertain.

Antidote: Charcoal.

PICROTOXIN. (C. S. P.) Fatal dose, two scruples.

Antidotes: Bromide, chlorine, iodine, charcoal.

PISCIDIA ERYTHRINIA. Jamaica Dogwood. (Narcotic.) Fatal dose, uncertain.

Antidotes: Same as for opium.

PLUMBI ACETAS. Acetate of Lead, Sugar of Lead. (I. P.) Fatal in large doses.

Antidotes: Sulphate of magnesia, sulphate of soda, phosphate of soda.

PLUMBUM. Metallic Lead. Fatal only as a cumulative poison. (C. S. P.)

Antidotes: Iodine, dilute sulphuric acid, sulphate of soda, sulphate of magnesia, albumen, casein, milk.

PLUMBI CARBONAS. Carbonate of Lead. (I. P.) Fatal in large quantities only.

Antidotes: Dilute sulphuric acid, iodine.

PLUMBI CHLORIDUM. Chloride of Lead (I. P.) Fatal in large quantities.

Antidotes: Sulphate of magnesia, sulphate of soda.

PLUMBI OXIDUM RUBRUM. Red Oxide of Lead. Fatal in large quantities. (I. P.)

Antidotes: Iodine, sulphate of soda.

PLUMBI OXIDUM SEMIVITREUM. Semivitrified Oxide of Lead. (Irritant Poison.) Fatal in large quantities.

Antidotes: Iodine, sulphate of soda.

POPPY. (Narcotic Poison in large quantities) (See Opium.)

Antidotes: Infusion of galls, tannic acid, charcoal, ammonia, green tea.

POTASSA. Caustic Potassa, Potash. Fatal dose one-half ounce. (Corrosive Poison.)

Antidotes: Fixed oils, vinegar, lemon juice.

POTASSÆ ARSENIAS. Arseniate of Potassa. (Ch. P.) Fatal dose, three grains.

Antidotes: Hydrated peroxide of iron, dialyzed iron, etc.

POTASSÆ ARSENIS. Arsenite of Potassa. (Ch. P.) Fatal dose, three grains.

Antidotes: Hydrated peroxide of iron.

POTASSÆ BICHROMAS. Bichromate of Potassa. (I. P.) Fatal dose, one drachm.

Antidotes: Carbonate of potassa, carbonate of soda, emetics.

POTASSÆ CARBONAS. Carbonate of Potassa, Pearlash. (I. P.) Fatal dose, one-half ounce.

Antidotes: Lemon juice, vinegar.

POTASSÆ NITRAS. Nitre. (I. P.) Fatal dose, one ounce.

POTASSÆ SULPHAS. (I. P.) Fatal dose, two drachms.

Antidotes: Demulcents and opiates.

POTTASII CYANIDUM. Cyanide of Potassium. (C—I. S. P.) Fatal dose, three grains.

Antidotes: Ferrous sulphate in solution.

PROPYLAMINE. Poisonous Alkaloid of decayed fish. (C—S. P.)

Antidotes: Stimulants and emetics.

PRUNUS LAUROCERASUS. Cherry Laurel. (C. S. P.) Fatal dose, one ounce water.

Antidotes: Dashes of cold water, ammonia inhaled, chlorine, chloroform inhaled.

PRUNUS PADUS. Cluster Cherry. (C. S. P.) Fatal dose, one ounce water.

Antidotes: Same as above.

PRUSSIC ACID. Fatal dose one grain.

Antidotes: Dashes of cold water, ammonia inhaled, chlorine inhaled.

PETRID ANIMAL MATTER. May produce symptoms of irritant poisoning, especially when taken in the form of spoiled sausages, bacon, ham, cheese, and goose grease. (See Tyrotoxicon and wounds (dissecting) in following section.)

Antidotes: Ammonia, tonics and emetics.

R.

RABIES CANINA. Hydrophobia. Fatal only by inoculation.

Antidotes: Nitrate of silver, ammonia, scutillaria, laterifolia. (?)

RANUNCULUS ACRIS. Crowfoot. Irritant poison. Fatal dose, uncertain.

Antidotes: Charcoal.

RED PRECIPITATE. Red Oxide of Mercury. Irritant poison, but rarely fatal.

Antidotes: Albumen, gluten.

RHUS TOXICODENDRON. Poison Oak or Sumac. Local poison also.

Antidotes: Charcoal internally; emollients externally.

RICINUS COMMUNIS. Castor Oil Plant. Seeds poisonous; fatal in large quantities.

Antidote: Charcoal.

ROBINIA PSEUDO-ACACIA. Locust Tree.

Antidote: Charcoal.

RUTA GRAVEOLENS. Rue.

Antidote: Charcoal.

S

SALIVA RABIES CANINÆ. Mad-dog Saliva. (See Rabies.) (C. S. P.)

Antidotes: Nitrate of silver, ammonia, scutillaria laterifolia.

SAMBUCUS EBULUS. Elder. Fatal dose, two tablespoonfuls powder (I. P.).

Antidote: Charcoal.

SANGUINARIA CANADENSIS. Bloodroot. (I. & II. P.) Fatal dose, uncertain.

Antidote: Charcoal.

SAUSAGE POISON. (See Putrid Animal Matter.)

Antidotes: Charcoal and emetics.

SCOMBEX SCERULEUS. Spanish mackerel. (See animal poison.)

Antidotes: Charcoal and emetics.

SCORPIO. Scorpion's sting. Fatal by inoculation only. (See Serpent's Venom.)

Antidotes: Whisky, ammonia, cinchonia.

SCYTALE PISCIVORUS. Water Viper. (See Serpent's Venom.)

Antidotes: Whisky, ammonia, cinchonia.

SCILLA MARATIMA. Squill, Sea Onion. (I. P.)

Antidotes: Bromine, chlorine, iodine.

SECALE CORNUTUM. Ergot, Spurred Rye. (I. & II. P.) Fatal only in large doses.

Antidote: Camphor.

SERPENTS, VENOM OF. *Boa Crotaloides*; Copperhead. *Crotalus Mockeson*; Mockeson. *Cerastes Nasicornis*; Horned Viper. *Coluber Berus*; Viper. *Coluber Prester*; Black Viper. *Crotalus* (five species); Rattlesnake. *Scytale Piscivorus*; Water Viper.

Antidotes: Asclepias, verticillata, anemone cylindrica, alcohol.

Treatment: A cupping-glass to be applied over the wound, or a mod-

erately tight ligature above the bites, and the wound left to bleed, after being well washed in warm water. The actual cautery, lunar caustic, to be then applied to it; afterward covered with lint dipped in equal parts of olive oil and spirits of hartshorn. If the inflammation be considerable, remove the ligature. Warm, diluting drinks, and small doses of ammonia to cause perspiration; the patient to be well covered in bed, and a little warm wine given occasionally. If gangrene be threatened, wine may be given more freely; bark also should be given. Arsenic, the principal ingredient in the Tanjore pill, has been strongly recommended. Hyperdermic injection of aqua ammonia.

SILVER. NITRATE OF. Lunar caustic. (C—S. P.) Fatal in small quantities.

Antidotes: Common table salt, albumen.

SNAKE'S BITE. (See Serpents, Venom of.)

Antidotes: Whisky, ammonia, chinchona, scutellaria, aselepias verticillata, anemone cylindrica.

SODA CARBONAS. Carbonate of Soda. An irritant poison rarely fatal.

Antidotes: Lemon juice, vinegar.

SOLANUM DULCAMARA. Bitter Sweet. Berries poisonous; sometimes fatal.

Antidotes: Charcoal and cardiac stimulants.

SORBUS ACICUPARIA. Mountain Ash. Flowers, bark and especially the root are irritant poisons.

Antidote: Charcoal.

SPARUS CHRYSOPS. Spurge.

Antidote: Charcoal.

SPIGELIA MARILANDICA. Pink Root. Fatal dose, three drachms.

(I. P.)

Antidotes: Charcoal and opiates.

STALAGMITIS GAMBEGIODES. Gamboge. Fatal dose, one drachm.

(I. P.)

Antidotes: Charcoal and opiates.

STANNUM. Tin. Powdered tin an irritant poison. Fatal dose, not known.

Antidotes: Albumen, milk, flour.

STANNI CHLORIDUM. Chloride of Tin. Fatal dose, one-half drachm.

(I. P.)

Antidotes: Albumen, milk, flour.

STRYCHNOS IGNATIO. St. Ignatius' Bean. Fatal dose, same as below. (C. S. P.)

Antidotes: Bromine, chlorine, iodine, prussic acid, prussiate of potassa, chloroform.

STRYCHNOS NUX VOMICA. *Nux Vomica*. (C—S. P.) Fatal dose, thirty grains, powder.

Antidotes: Same as above.

STRYCHNIA. Alkaloid of above. Fatal dose, one-fourth grain. (C. S. P.)

Antidotes: Same as above.

SULPHATE OF INDIGO. Fatal dose, one drachm. (Corros. poison.)

Antidotes: Magnesia, lime, milk.

SULPHURETTED HYDROGEN GAS. Inhalation poisonous. (A. P.)

Antidote: Chlorine inhaled cautiously.

SULPHUROUS ACID GAS. Poisonous only by inhalation. (Anæsthetic.)

Antidote: Ammonia inhaled cautiously.

T

TANACETUM VULGARE OLEUM. Oil of Tansy. Fatal in one-half ounce doses. (C. S. P.)

Antidote: Charcoal. Chloroform by inhalation.

TARANTULA. (See Venom of Serpents.)

Antidote: Ammonia; whiskey.

TAXUS BACCATA. Yew. Berries poisonous, generally fatal. (I. P.)

Antidotes: Charcoal, emetics.

TETRONS CELERATUS. Tunny.. (See animal poisons.)

Antidote: Charcoal, emetics.

TIN, MURIATE OF. Fatal dose, one drachm. (I. P.)

Antidotes: (See Stanni Chloridum.)

TICUNAS. Indian War Poison. Fatal in smallest quantities.

Antidotes. Iodine; Iodide of Potassa.

TURPETH MINERAL. Yellow Sulphate of Mercury. Fatal dose, one ounce. (I. P.)

Antidotes: Mucilage, albumen.

TYROTOXICON. (I. P.) Ptomain discovered by Vaughan in decomposing milk, ice cream, etc.

Antidotes: Emetics and stimulants.

V

VENOMOUS INSECTS. *Tarantula*. *Scorpio*: Scorpion. *Vespa Crabro*: Hornet. *Vespa Vulgaris*: Wasp. *Apis Mellifica*: Bee. *Culex Pipiens*: Gnat. *Esirus Boris*: Gadfly. Hartshorn and oil may be rubbed on the affected part, and a piece of rag, moistened in the same, or in salt and water, may be kept upon it, till the pain is removed. A few drops of hartshorn may be given frequently in a little water; and a glass or two of wine may be taken. The sting may in general be removed by making strong pressure around it with the barrel of a small watch key.

VERATRUM ALBUM. White Hellebore. Fatal dose, one drachm extract. (H. P.)

Antidotes: Cardiac stimulants.

VERATRUM VIRIDE. American Hellebore. Fatal dose, one drachm. (H. P.)

Antidotes: Same as above.

VERATRIA. (H. P.) Active principle of hellebore, and poisonous like it though in much smaller quantities.

Antidotes: As above.

W

WHITE PRECIPITATE. Ammoniated Mercury Chloride. Fatal in large doses. (I. P.)

Antidotes: Mucilage, fixed oils.

WOORARA. Guiana arrow poison. Fatal in smallest quantities. (C. S. P.)

Antidotes: Iodine, Iodide of Potassium.

Y

YEW. (I. P.) Berries poisonous, often fatal.

Antidotes: Charcoal and emetics.

Z

ZEA MAYS. Indian corn smut. (H. P.) Like ergot and in similar doses.

Antidotes: Stimulants and camphor.

ZINCI SULPHAS. Sulphate of Zinc. Fatal dose, one drachm. (I. P.)

Antidotes: Albumen, carbonate of soda, tannic acid, astringent.

POISON BY INOCULATION.

The subject of poisons would scarcely be complete without somewhat further mention of septic infection, perhaps the greatest danger incident to the embalmer's art. It has long been known that the introduction of certain kinds of decaying animal matter into the system through a scratch or cut is often attended with the gravest consequences. In a few hours after such an accident the wound becomes red and painful and contiguous parts swollen. There is often at the same time sufficient constitutional disturbance to produce a chill followed by fever, which latter persists so long as there is extension of the swelling, and pain due to an extension of the local poisoning. We have, as says another, in addition to the high fever with its intermissions, disordered digestive functions, great prostration, and, after death, a fluid state of the blood which abounds in bacteria, more or less extensive blood-extravasations in internal organs, and frequently in the more tardy cases, phlegmonous nodules or abscesses.

But in a second victim of the same poison there may be little or no constitutional disturbance; only a diffuse red erythematous or erysipelatous swelling around the wound, or, at worst, an abscess in the vicinity of the sore or in the nearest connecting lymphatic glands. In this case the blood (usually) contains no bacteria, but they abound in the local inflammatory products or in the pus of the abscess.

Or in other words we have in the first case bacterial poisoning, and in the second pyæmia. It is the first that is the cause of death in cases of fatal dissection wounds and its possibility should always be kept in mind in handling the dead with cracked or wounded hands. Not all bodies are dangerous thus to handle, for these dangerous bacterial forms are not produced in all, but only under favorable circumstances. The modern intelligent use of antiseptics has greatly diminished this source of danger, but Le Bon's axiom should always be kept in mind in such cases, viz.:

“*There is no parallelism between the toxic properties of a putrefying liquid and its emanations*” in fact they seem to stand in inverse ratio viz.: the newer the putrefaction, the more toxic its properties, the older the liquids the more toxic its exhalations, as proven by frogs, thriving in a putrid bacterial fluid, which was rapidly fatal when injected.

are killed by vapors of same fluids two months later although it was then harmless when injected. So that the putridity of a fluid bears no relation to the danger of its inoculation: therefore the early handling of a corpse is often more dangerous than when it has become rotten with putridity. This is easily explainable by what has already been said on the subject of bacteria (Section IV.) whose rapid multiplication within the body probably cause the toxic symptoms in these and similar cases of zymotic disease.

The symptoms of slow blood poisoning thus produced are well described by a recent writer as follows : " Dull headache and aching pain originating at the points of infection, restless, unrefreshing sleep and wandering pains in the limbs. There is also loss of appetite and a bad taste in the mouth, with irregular chills and foul urine and discharges from the bowels. If not relieved, after a longer or shorter time violent chills set in, followed by a moderate or an intense fever heat. This heat has the peculiarity of imparting to the hand a stinging, biting sensation. Generally the septic symptoms only, make their appearance after the patient has become debilitated to such an extent that he faints away when the least attempt is made to raise them or to change the position. The breath and the bodily exhalations and spread of putrid odor increase, so that when the patient raises the bed clothing by his motion, a sickening stench affects the nostrils. The stools and the urine have also a cadaveric smell and there is escape of the blood by readily-bleeding gums, in consequence of which the mouth, the tongue, the teeth and the lips acquire a black-brown appearance. There is frequent nose bleed, vomiting of blood, bloody and foul-smelling, diarrhœic stools, hemorrhages from the vagina or the uterus. Bed sores break out and generally become gangrenous. If the disease reaches the highest degree of intensity, a continued sleep sets in, with trembling of extremities, twitching of the muscles, grasping at flocks, involuntary evacuations, cold perspirations, and fainting fits. Then the patient dies from exhaustion."

TREATMENT consists in prompt cauterization of the wound with nitrate of silver, nitric acid or saturated solution of chloride of ammonia in all suspected cases. If pain and inflammation set in, a poultice should be applied and full doses of quinine taken, until a competent physician can be called, to whom the case should be committed.

SECTION VIII.

ALPHABETICAL LIST OF ANCIENT AND MODERN ANTISEPTICS,
DISINFECTANTS, SPORICIDES AND DEODORIZERS.

SECTION VIII.

DISINFECTANTS, ANTISEPTICS AND SPORICIDES.

A *disinfectant* is a substance used to *counteract* the products of putrefaction and decomposition.

An *antiseptic* is a substance used to *prevent* putrefaction and decomposition.

A *deodorizer* is an agent that either absorbs, or destroys the offensive gases after they are formed, but does not prevent their formation; in other words, does not prevent putrefaction.

Sporicides.—Most of the antiseptics act by paralyzing the evolution of the microbic germs, and by destroying the adult bacteria, but have no effect on the germs of the bacteria. Certain substances, however, have by their chemical action the power of completely destroying the germs of the bacteria, and to this class Dr. Miguel has applied the term "sporicides." The principal among them are the preparations of mercury, and the salts of silver, which in a solution of $\frac{1}{100,000}$ destroy in a few days the germs of microbes as surely as a dry temperature of 150° C. (302° F.) prolonged during several hours. Iodine, chlorine and bromine, and the mineral acids come next, but the microbicide par excellence is heat, which, raised to 110° C. (230° F.) for liquids, and to above 150° C. (302° F.) for solids has been found sufficiently effectual to destroy the germs of the microbes.

There is very little uniformity in the use of these words, which are, unfortunately, used indiscriminately even by scientific writers. In popular use any agent which destroys or covers a bad odor is called both antiseptic and disinfectant, although it may act merely as a deodorizer without any effect upon decomposition or putrefaction, or the development of bacterial germs (See Section IV.). As a matter of fact recent researches have proven that many of these deodorizers are valueless as sporicides, though excellent to destroy foul odors, as, for instance, ferrous sulphate. So wide is this misuse of so-called disinfecting agents that Duggan, in a recent article on this subject, says: "I am satisfied that three-quarters of all disinfectants sold to individuals are * * * substitutes for cleanliness. Under this class of 'substitutes for cleanliness' may be included the various water-closet disinfecting machines. Aside from being totally inefficient, so far as destroying organisms is concerned, the fact that they are necessary to prevent odors is the best

evidence that the closet or water-supply is not what it should be. If we take away the odor simply, in such cases, there is nothing left to remind us of impending danger."

There is no parallelism, says Le Bon, between the power of an antiseptic to prevent putrefaction and to check it when once set in; *e. g.*, alcohol and carbolic acid are powerful preventives, but act feebly when putrefaction has commenced.

With perhaps the exception of corrosive sublimate and a few other powerful poisons, the greater part of the antiseptics now in use have but a very feeble action on bacteria. Miguel has lately published a memoir describing the results of his experiments upon bacterial organisms. Bacterial germs and adult bacteria were added to broth, and by noting the quantities of antiseptic substances which served to prevent the putrefaction of a liter of broth, a general classification of antiseptics was made as follows:

1st Class. "*Generally antiseptic*" bodies, of which from .01 to .10 grammes (.15 to 1½ grains) suffice to preserve one liter (1.7 pints) of broth from putrefaction. This class includes peroxide of hydrogen and bichloride of mercury.

2d Class. "*Very powerful antiseptics.*" or bodies of which from .10 grammes to 1.0 grammes (1.5 to 15 grains) are required to preserve one liter of broth. Iodine, chloride of gold, tetrachloride of platinum, hydrocyanic (prussic) acid and bromine come under this heading.

3d Class. "*Powerful antiseptics.*" of which from 1.0 to 5.0 grammes (15 to 75 grains) are required. Chloroform, potassium bichromate, ammonia, thymol, phenol, permanganate of potassium, nitrate of lead, alum.

4th Class. "*Moderately antiseptic*" bodies, from 5 to 20 grammes (75 to 300 grains) being required. Hydrobromate of quinine, white arsenic, sulphate of strychnia, boric acid, arsenite of soda, hydrate of chloral, salicylate of soda, caustic soda.

5th Class. "*Slightly antiseptic substances.*" from 20 to 100 grammes (300 to 1,500 grains) being required to preserve the liter of broth. Borate of soda, hydrochlorate of morphia, alcohol.

6th Class. "*Very slightly antiseptic substances,*" includes those bodies of which from 100 grammes to 300 grammes are required, and under this head M. Miguel mentions iodide of potassium, common salt, glycerine, ammonium sulphate, and sodium hyposulphite. Substances, such as sugar, which must be present in a much larger proportion in order to exercise a preservative action, are placed outside the category of antiseptics.

The choice of the disinfectant, or antiseptic, for the uses of the embalmer should be made in accordance with the above table and other

special considerations elsewhere discussed. In making this choice it should also be remembered that while an antiseptic agent is not necessarily a disinfectant, as a rule disinfectants are antiseptics; for putrefactive decomposition is due to the development of "germs" of the same class, and that which destroys the latter also destroys the bacteria of putrefaction, when brought in contact with them in sufficient quantity, or restrains their development when present in smaller amounts. Further

(a) Animal matter can be preserved from putrefaction either by congelation, and other natural antiseptics (See page 538), or

(b) By preventing a direct contact of animal matter with the surrounding atmosphere, either by gases or unoxidizable substances, or

(c) Animal substances may be combined with others to form new chemical compounds which will not readily putrefy.

Of *gaseous disinfectants* we may best use sulphurous acid, chlorine or bromine, and to this list also may be added iodine. The results of recent researches prove that of the agents available from the cheapness as disinfectants, corrosive sublimate, permanganate of potassium, chlorine, bromine, and perhaps the chloride of zinc, are the only ones having sufficient germicidal power to be worthy of consideration as sporicides.

But aside from efficiency there are other qualities requisite in the antiseptics best adapted to the embalmer's use, for as Dr. Wywodzoff, of St. Petersburg, Russia, says: "For perfect preservation of human bodies, the following things are necessary: The body should remain in a soft and flexible condition for at least three months, the tissues should not change color, the material should not be injurious to the health of the operator, nor spoil the instruments used in the operation, and it must be either free from or have an agreeable odor, and be cheap, to fulfil the above conditions." In short the *perfect preservative* for animal matter if ever found will be found to be:

1. Colorless and odorless, or without unpleasant smell.
2. Not corrosive nor poisonous, that is safe for general use.
3. Able to preserve the body flexible, and of natural color.
4. Cheap, if possible.
5. Stable.

6. Efficient, that is it must be able in case putrefaction has already begun to perform its duties as

A reliable antiseptic,	} that is prevent the evolution of gases, purging
Disinfectant and	
An anti-ferment,	

and swelling, and also ought to be able to prevent discoloration, and bleach if necessary.

Have we any that will meet all these requirements? As yet there are none, for if there were, embalming would resolve itself into the simplest kind of mechanical work. As it is, it requires the best judgment, and all the

knowledge of chemistry procurable, to select the proper antiseptics for each case; to this end we shall as briefly as possible review all the substances of which we can find any account of their use as antiseptics or disinfectants, noting the advantages and disadvantages of each. And first to make the list complete, we again mention:

I. THE NATURAL DISINFECTANTS,

or those which act by assisting putrefaction, and thus removing the offensive substance. They have already been discussed, as indicated by the accompanying reference:

1. Air. (See page 229.)
2. Water. (See page 132.)
3. Soil. (See page 231.)
4. Cold. (See page 232.)
5. Heat. (See page 355.)

The arguments *pro* and *con* cremation may be found in Section I, pages 16-24; but aside from the destruction of the body by fire, it is interesting to note how general has been the use of fire as a disinfecting agent. As early as the days of Hippocrates fires were lighted by his order in the public places in Athens during time of plague. These fires were made from resinous and odoriferous woods, and were undoubtedly of value. Paulet furthermore says: "This confidence in the purifying action of fire was very like that which was held in regard to that of the smoke of powder in cannonading; for it was the custom, and frequently recommended, to discharge in time of epidemics a large number of pieces of artillery at dawn and sunset, because in this way would be added the effect of the impetuous shock produced in the air to that of flame and the odor of powder, which is composed of substances said to be hostile to decomposition, such as sulphur and nitre. In this way it was thought that the aerial corpuscles were driven away or consumed." If for corpuscles we substitute bacterial germs, we shall find the teachings of modern science very like that of Hippocrates: for hot steam (110°-130° C.) is recommended by the American Health Association as the best sporicide known, and a heat of 300° F. is said to be destructive of all forms and germs of bacterial life. (See page 236.)

II. Next to the natural disinfectants in historical order are the agents employed for the preservation of organic matter in the earliest times. These may be arranged in alphabetical order as follows:

EARLIEST ANTISEPTICS.

1. Alum.
2. Balms.
3. Cedria and turpentine.
4. Charcoal.
5. Desiccation.
6. Fixed and aromatic oils.
7. Honey.
8. Natron.
9. Pitch.
10. Resin.
11. Sea-salt.
12. Smoke.
13. Sulphur.
14. Tannin.
15. Vinegar.
16. Wax.

All of these substances exercised their preservative powers either by

(a) Preventing direct contact with the air by means of antiseptic oils, balms, honey, wax, etc., or

(b) Formation of new chemical compounds which are less putrescible, as in the case of alum, salt, smoke, tannin, etc.

III. SUBSTANCES EMPLOYED IN THE MIDDLE AGES AND UP TO THE BEGINNING OF THE PRESENT CENTURY.

Absinth.	Cloves.
Acetate and nitrate of lead.	Coriander seed.
Alcohol.	Cumin.
Aloes.	Dried oranges.
Ambergris.	Gentian.
Angelica root.	Ginger.
Balmgently leaves.	Gunpowder.
Balsam of Copaiva.	Hyssop.
Balsam of Peru.	Ice.
Basilic.	Iris root.
Benzoin.	Juniper fruit and seeds.
Brine.	Laurel.
Calamite.	Lavender.
Calamus.	Malmsey wine.
Camphor.	Marjory.
Canella.	Mercurial salts.
Cardamum seed.	Mercury.
Caraway.	Mineral acids.
Cedar wood.	Mint.
Citron and orange peel.	Musk.
Civet.	Myrrh.

Nitrate of potassium.	Southern wood.
Nitrate of silver.	Spirits of wine.
Nutmeg.	Spurge.
Odoriferous rush.	Styrax.
Olibanum.	Sulphate of copper.
Olive oil.	Sulphate of iron.
Orange flowers.	Sulphurous acid.
Origanum.	Syrmæa.
Quinia.	Tar.
Rosemary.	Tartrate of potash.
Roses.	Thyme.
Rue.	Urine.
Sage.	Valerian.
Santal citron.	Venice turpentine.
Savory.	Vinegar.
Scordium.	White pepper.

Those of these of any real value are again mentioned under Modern Antiseptics.

MODERN ANTISEPTICS.

For convenience in arrangement, modern antiseptics will be considered under the heads of (1) Gaseous Antiseptics; (2) Chemical Antiseptics; (3) Patent Preservatives and processes not elsewhere described.

1. GASEOUS ANTISEPTICS.

CARBONIC ACID. *Carbonic Dioxide, See Carbonic Anhydride.*

CARBONIC ANHYDRIDE. *Synonym:* *Carbonic acid gas, etc., see page 138.* Specific Gravity 1.529. A colorless, transparent, irrespirable gas. See page 44. (A.)

CARBONIC MONOXIDE AND ANHYDRIDE Combined. The former of these is described on page 219. Combined with carbonic anhydride it has afforded excellent results as an antiseptic. See page 44. (A.)

CHLORINE. Specific Gravity 35.5 H. A greenish-colored, irritating gas pronounced by Koch the best of the few certain disinfectants. (A. & D.)

Objections: It is a very irritating gas; its solution is incompatible with all salts of lead, silver, and compounds containing hydrogen.

HYDROCHLORIC ACID GAS. *Synonym:* *Muriatic Acid.* Specific Gravity 36.5 H. A colorless, irritating gas, with an acid taste, and sharp, irritating odor. (A. & D.) It is only feebly disinfectant. See page 43.

MURIATIC ACID GAS. (*See Hydrochloric Acid Gas.*)

OXYGEN. (See page 111.) Buchner succeeded by supplying oxygen very freely in converting the so-called infectious hay-bacillus into

perfectly innocuous bacteria. Feltz found that compressed oxygen (15 atmospheres) killed bacilli but was harmless to the spores. Bert showed that compressed oxygen killed the bacillus but had no effect on chemical poisons already developed in the liquid.

SULPHUROUS ACID GAS. *Synonyms: Sulphur Dioxide, Sulphurous Anhydride, Sulphurous Oxide.* Specific Gravity 32.25 H. It is a pungent gas, having the odor of burning matches. It is not poisonous, is a good preventive of fermentation and good for bleaching. (See page 45.)

Objections: It is not cheap, is unpleasant and unstable, and evolves sulphuretted hydrogen with decomposing tissues. The great objections however, to the use of all gases are their bulk, apparatus necessary for preparation, and their failure properly to permeate the tissues: hence they have never come into general use, and modern embalming relies exclusively upon

2. CHEMICAL ANTISEPTICS.

N. B. Those insoluble in water are printed in italics. (A), Antiseptic; (D), Disinfectant; (S), Sporicide.

ABSOLUTE ALCOHOL. *Specific Gravity 0.794. Formula, C_2H_6O .* A colorless, pungent, inflammable fluid, differing from ordinary alcohol in being free from water. It preserves by imbibing a portion of the water of composition, and bleaches, discolors and hardens the organs. (A.)

Objections: Action upon the tissues, expensiveness, and volatility.

ACETATE OF ALUMINIUM. *Formula, $(C_2H_3O_2)_3(Al_2)$.* A compound which can be kept only in the state of solution. It has a faint smell of acetic acid, and possesses strong antiseptic properties. An aqueous solution at 12.5° contains 10.6 per cent of it. By many this is considered one of the most valuable antiseptics and deodorizers. A. & D.

ACETIC ACID. (For synonyms, properties, etc., see page 261.) Acetic acid preserves flesh only by drying it, and is said to be one of the least efficient of the disinfectants. A. & D.

Objections: Disagreeable odor and inefficiency.

ACETONE. (See Wood Naphtha.)

ALCOHOL. (See Ethyl Alcohol.)

ALKALIES. Concentrated lyes dissolve all animal matter, weak alkaline solutions disorganize more or less promptly the same substances. The alkalis are useful under certain conditions in transforming the fat of certain animal substances into soap, thus facilitating their desiccation. (See page 223.)

ALUM. *Synonym: Double sulphate of alumina and potash. Specific gravity 1.724. Formula, $Al_2K_2(SO_4)_4+24H_2O$.* A transparent, colorless salt, with an astringent taste. It is a good preservative agent for the

membranous parts of the body. It is classed by Miguel among the powerful antiseptics. It is soluble in 0.27 parts of boiling water.

Objections: Alum is decomposed and the animal matter unites with the alumina, and the liberated sulphuric acid produces alteration of the tissues. It is incompatible with corrosive sublimate, salts of lead, potash, ammonia, and vegetable infusions.

ALUMINA, HYDRATE OF. *Synonym:* *Aluminium hydrate*. *Formula*, $Al_2(OH)_6$. A white, amorphous, inodorous, tasteless powder. It is soluble in acetic and the dilute mineral acids.

ALUMINIUM ACETATE. (See Acetate of Aluminium).

ALUMINIUM CHLORIDE. *Formula*, Al_2Cl_6 . A substance crystallizing in colorless, hexagonal prisms. Fusible, volatile. Very soluble. An impure solution is used as a disinfectant under the name of Chloralum.

Objection: It is incompatible with mercurous, lead and silver salts.

ALUMINIUM NITRATE. This salt dissolved in brandy has been used for the preservation of soft objects.

ALUMINIUM SULPHATE. *Formula*, $Al_2(SO_4)_3 + 18H_2O$. A white crystalline powder, permanent in the air, soluble in 1.2 parts of water at 15° C. A. D. Its chief use is as an antiseptic. It is placed by Miguel in class 6, as it requires 250 grammes to the litre to prevent bacterial formation.

AMMONIA, CONCENTRATED SOLUTION. (For the properties of this soluble gas, see page 220.) A. D. Miguel considers ammonia one of the powerful antiseptics, for it requires but 1.4 grammes to the litre to act as an antiseptic.

AMMONIUM CHLORIDE. *Synonyms:* *Sal-Ammoniac*, *Muriate of Ammonia*. (See page 141.)

AMYL ALCOHOL. *Synonyms:* *Potato Spirit*, *Fusel Oil*, *Specific gravity*, 0.8184. *Formula*, $C_5H_{11}OH$. A colorless, oily liquid, having an acid taste and peculiar odor. It mixes with alcohol and ether, but not with water. A. It is a better antiseptic than ordinary alcohol. Belongs to Miguel's group 5.

Objection: Its odor is nauseating, and provocative of severe headache.

ANILINE. *Synonyms:* *Amido-Benzene*, *Amido-Benzol*, *Phenylamine*, *Kyanol*. *Specific gravity*, 1.02 at 16°. *Formula*, C_6H_7N . A colorless liquid with a peculiar aromatic odor, and an acrid, burning taste. Soluble in 31 parts of cold water. A. It belongs to Miguel's third class of antiseptics, powerful antiseptics.

ARGENTIC IODIDE. (See Silver, Iodide of.)

ARGENTIC NITRATE. (See Silver, Nitrate of.)

ARSENIC, WHITE. (See Arsenious Acid.)

ARSENIOUS ACID. *Synonyms:* *White Arsenic*, *Arsenic Trioxide*, *Arsenic*. *Specific gravity*, 3.785. *Formula*, As_2O_3 . A heavy white

solid, occurring either in transparent or semi-transparent masses, or as a white, crystalline powder. The crystalline modification is soluble in about 9 parts of water at $15^{\circ}\text{C}.$, while the amorphous variety requires 25 parts of water for solution. A. D. Koch found that a 1 to 2 per cent solution will kill the organisms of splenic fever in 6 to 10 days. Miguel places it second in his list of "moderate antiseptics," as it requires 6 grammes to the liter to prevent putrefaction in normal broth.

Objections: It is very poisonous; it seems to favor the dessication of bodies though it preserves them well.

ARSENIATE OF SODA. (See Sodium Arseniate.)

ASEPTOL. (See Ortho-Phenol Sulphate.)

AURIC CHLORIDE. (See Gold, Chloride of.)

BENZINE. *Synonym:* Benzolene. *Specific gravity*, 0.73. A colorless liquid obtained from crude petroleum. It is largely used in the arts as a solvent for fatty substances. It is soluble in about six times its volume of alcohol.

BENZOIC ACID. *Synonym:* Phenyl-Formic Acid. *Formula*, $\text{C}_7\text{H}_5\text{O}_2$. Colorless, soft, needles or laminae of a silky luster, inodorous when cold and pure. Obtained from solutions in pearly needles or plates. It is soluble in 500 parts of water at $15^{\circ}\text{C}.$, and in 15 parts of boiling water. A. D. The experiments of Andrews and Buchholtz place this the fifth in the list of antiseptics. Miguel places this in his list of "powerful antiseptics." Gum benzoin contains benzoic acid, and has long been one of the best known antiseptics.

BITUMEN. (See Pisasphaltum.)

BLEACHING POWDER. (See Lime, Chloride of.)

BORACIC ACID. *Synonyms:* Boric Acid, Orthoboric Acid. *Specific gravity*, 1.4347 at 15° . *Formula*, H_3BO_3 . Brilliant, crystalline plates, unctuous to the touch, odorless, slightly bitter, soluble in 25 parts of water at 10° . A. Five grammes to the litre will arrest putrefaction, according to Miguel. Moderately antiseptic.

BORAX. *Synonyms:* Biborate of Sodium, Borate of Sodium. *Specific gravity*, 1.72. *Formula*, $\text{Na}_2\text{B}_4\text{O}_7 + 10\text{H}_2\text{O}$. Colorless, transparent, hard prisms. At red heat forms a glass. Soluble in 16 parts of water at $15^{\circ}\text{C}.$ A. Its antiseptic powers are feeble, in the proportion of 70 to 1000. Koch found borax in any ordinary solution incapable of killing the spores of splenic fever.

BORIC ACID. (See Boracic Acid.)

BORO-GLYCERINE. A glacial, translucent, soluble substance without taste. It is prepared from glycerine and boracic acid.

A. D. It is cheap, an excellent antiseptic, safe, odorless and not acted upon by tannin, or dilute acids. According to Buchholtz and Andrews it has about the same value as alcohol as an antiseptic.

Objections: It is a poor disinfectant; it does not coagulate albumen.

BORO-PHOSPHATE OF SODA. (See United States Patents, No. 276, 246, dated April 24, 1883.)

BRANDY. (See Kirschwasser and Ethyl Alcohol.)

BROMINE. *Specific gravity, 2.99 at 15° C. Formula, Br.* A heavy, dark, brownish-red, very volatile liquid, of an intense and suffocating odor. Soluble in 33 parts of water at 15°.

A. D. S. A mild disinfectant; Koch places bromine second in his list of certain disinfectants. Bromine is one of the few active antiseptics, a two per cent solution killing the spores within a day. Belongs to Miguel's second class.

Objections: The fumes are very irritating to throat and eyes. It stains the skin yellowish-brown. Like chlorine it can only be used in very moderate quantities in inhabited rooms.

BUTYL ALCOHOL. *Synonym: Propyl carbinol. Formula, C₄H₁₀O.* A colorless liquid, soluble in 10 parts water.

A. An excellent antiseptic, being better than ordinary alcohol.

Objection: Its odor is that of rancid butter.

CALCIUM HYPOCHLORITE. (See Lime, Chlorinated.)

CARBOLIC ACID. *Synonyms: Phenic acid, phenol, phenylic alcohol. Specific gravity, 1.065 at 18°. Formula, C₆H₆O.* Long, colorless needles or crystalline masses, possessing a peculiar, distinctive odor, and a sharp, burning taste. Soluble in 20 parts of water at 15° C.

A. D. Two per cent solutions of carbolie acid only hinder the development of spores, while even five per cent is not sufficient to kill them. One per cent solution killed splenic fever bacilli in a few minutes. Grouped by Miguel in class 3, or "powerful antiseptics," requiring for efficiency 3.2 grammes to the litre.

Objection: It is difficult to secure the proper quality, and it must be used in large quantities to be of any service.

CAUSTIC SODA. (See Soda, Caustic.)

CHARCOAL. *Specific gravity, about 1.57.* Brittle product of combustion of woody fiber with an insufficient supply of air.

A. D. Charcoal has the property, when fresh heated, of absorbing gases, taking up 9 volumes of oxygen, 90 of ammonia gas, and 30 of sulphuretted hydrogen. It is a powerful deodorant, and oxidizes offensive organic effluvia.

CHLORAL HYDRATE. *Synonym: Chloral. Specific gravity, 1.575. Formula, C₂HCl₃O + H₂O.* Colorless semi-transparent, needle-shaped crystals, or crystalline plates, possessing a peculiar ethereal odor and pungent taste. Soluble in about half their weight in water.

A. It is not poisonous, is cheap, is said to bleach discolored

tissues : according to Buchholtz and Andrews a solution of one part in 400 will arrest bacterial development. Belongs to Miguel's fourth class.

Objections: It is very irritating when powdered ; darkens with volatile sulphur compounds : is decomposed by ammonia ; forms a paste with fats.

CHLORALUM. (See Aluminium Chloride.)

CHLORIDE OF ALUMINIUM. (See Aluminium Chloride.)

CHLORIDE OF GOLD. (See Gold, Chloride of.)

CHLORIDE OF IODINE. CHLORIDE OF LEAD, ETC. (See Iodine, Chloride of, Lead, Chloride of, etc.)

CHLORINATED SODA. (See Sodium Hypochlorite.)

CHLOROFORM. *Specific gravity, 1.502 at 15° C. Formula, CHCl_3 .* A dense, colorless, volatile, and limpid liquid, of an agreeable, aromatic odor, and sweetish taste. Slightly soluble in water, one part requiring about 200 parts of water for solution.

A. Placed in a jar with any part of the body which it is desired to preserve, will well preserve it, so long as the jar is kept closely corked and filled with vapor of chloroform.

In proportion of 1 to 2 grammes to the litre of beef broth will prevent putrefaction.

CHROMIC ACID. *Synonym: Chromic anhydride. Specific gravity, 2.819. Formula, CrO_3 .* This substance is improperly called chromic acid, the proper term being chromic anhydride. It occurs in long, scarlet prisms of considerable luster, or in masses of loose, bright red, acicular crystals.

A. Chromic acid is said to have the greatest power of destroying infusoria. It is a very powerful oxidizing and bleaching agent, and stands seventh in Miguel's list of antiseptics, ranking among "very powerful."

Objections: Oxidizing properties in strong solution, and the crimson stain which it imparts to the tissues.

CHROMIC ANHYDRIDE. (See Chromic Acid.)

COCOANUT OIL. Coconut Oil is used in the South Sea Islands as a disinfectant and preservative.

COPPERAS. (See Iron, Sulphate of.)

COPPER NITRATE. *Synonym: Cupric nitrate. Formula, $(\text{NO}_3)_2\text{Cu}$.* Deep blue, soluble crystals, highly corrosive.

D. Feebly disinfectant.

COPPER SULPHATE. *Synonyms: Blue Vitrol, Cupric Sulphate. Specific gravity, 2.277. Formula, $\text{CuSO}_4 + 5\text{H}_2\text{O}$.* Large, transparent crystals of a deep blue color. Soluble in 2.6 parts of water.

A. Coagulates and destroys living organisms. One of Miguel's very

powerful antiseptics, since it requires only 0.8 grammes to preserve a litre of broth from putrefaction.

CORROSIVE SUBLIMATE. *Synonyms:* *Bichloride of Mercury, Mercuric Chloride.* *Specific gravity, 5.403.* *Formula, $HgCl_2$.* Colorless, translucent, heavy crystalline masses, when obtained by sublimation, or small rhombic prisms when crystallized from solution.

A. D. S. Koch says: "Corrosive sublimate is one of the three certain disinfectants, and stands at the head of the reliable disinfectants." A solution of 1 to 1,000 of corrosive sublimate killed the resisting spores, and solutions of 1 to 15,000 are sufficient to kill the micro-organisms.

CREASOTE. *Synonym:* *Creasote.* *Specific gravity, 1.035 to 1.085 at 12°.* A mixture of various substances such as cresol, phlorol, etc., obtained from wood-tar. A colorless, or pale yellow, transparent, oily refractive liquid, of an odor resembling that of smoked meat and of a caustic, pungent taste. Very sparingly soluble in water.

A. The experiments of Buchholtz and Andrews seem to show that a 1 to 2000 solution of creasote arrests bacterial developments.

Objections: Expensiveness and disagreeable odor.

CRESYLIC ACID. *Synonyms:* *Cresylol, Cresol.* *Formula, C_7H_8O .* A crystalline solid having the odor of creasote.

ESSENTIAL OILS. (See Turpentine.)

ESSENCE OF BITTER ALMONDS. *Synonyms:* *Essence of Mirbane, Nitro-Benzol, Nitro-Benzene.* *Specific gravity, 1.209 at 15°.* *Formula, $C_6H_5(NO_2)$.*

A yellowish liquid with a sweet taste and a pronounced odor of bitter almonds. Almost insoluble in water, soluble very readily in alcohol and ether.

A. It is placed in Miguel's third class, being, according to his table, exactly equivalent to carbolic acid in its antiseptic properties.

ESSENCE OF MIRBANE. (See Essence of Bitter Almonds.)

ETHYL ALCOHOL. *Synonyms:* *Alcohol, spirits of wine, ethyl hydrate etc.* *Specific gravity of the ordinary alcohol, containing about 15 percent of water, 0.835 to 0.838.* *Formula, C_2H_6O .* A colorless, transparent, inflammable liquid.

A. A very old antiseptic, and one of the most popular, though feeble. More largely used than any other for museum specimens. Miguel states that it requires 1 to 10 to make it efficient.

Objections: Poor antiseptic, expensive, volatile, not disinfectant and of very little value when decomposition has set in.

EUCALYPTOL. *Formula, $C_{12}H_{20}O$.* An essential oil contained in the leaves of the *Eucalyptus globulus*, an Australian tree. A. Buchholtz and Andrews' experiments show that in a solution of one part to 666 it arrests bacterial development.

FERRIC ACETATE. (*See Iron, Acetate of.*)

FERRIC ACID. *Synonym: Peroxide of Iron. An improper name for the peroxide. Formula, Fe_2O_3 .*

A. D. Highly recommended by Elkund as an injection in connection with saturated solution of salt.

FERRIC CHLORIDE. *Synonyms: Chloride of iron, perchloride of iron. Formula, $Fe_2Cl_6 + 12H_2O$.* Orange-yellow, crystalline masses, or large, brownish-red tables. A. D. One to two per cent solution kills the organisms of splenic fever in six to ten days, but it is on the whole quite a feeble disinfectant.

FERRIC HYDRATE. *Synonym: Peroxhydrate of Iron. Formula, $Fe_2(HO)_6$.* A reddish-brown, tasteless powder, destitute of grittiness.

FERROUS SULPHATE. (*See Iron Sulphate of.*)

FUSEL OIL. (*See Amyl Alcohol.*)

GALLIC ACID. $C_7H_6O_5 + H_2O$. Small acicular prisms or silky needles, or a crystalline powder of a pale fawn color, and containing one molecule of water of crystallization. A. Gallic acid acts in the same manner as Tannin, but more feebly. (*See Tannin.*)

GLYCERINE. *Synonym and properties, see page 263.* A. A solution of 1 to 400 is antiseptic and especially well adapted for the preservation of small objects except that it dehydrates them if their specific gravity is less than that of glycerine. According to Buchholtz, one of the weakest antiseptics, requiring one part to four to arrest development.

Objections: Does not bleach, does not disinfect, expensive antiseptic, exudes by injection.

GOLD, CHLORIDE OF. *Synonyms: Auric chloride, gold trichloride. Formula, $AuCl_3$.* Deliquescent yellow prisms, very soluble in water, alcohol and ether. A. Very powerful antiseptic; according to Miguel 0.25 grammes to litre of normal beef broth arrest putrefaction.

Objections: Expense, stains the skin purple.

GUTTA PERCHA. A tough, inelastic, brownish substance, having an odor similar to that of caoutchouc. Insoluble in water, alkaline solutions, dilute acids and fatty oils, soluble in benzine, oil of turpentine, essential oils, chloroform and carbon bisulphide. A. Applied to substances from its solution in chloroform or bisulphide of carbon, it leaves an impervious covering which prevents putrefaction.

HELLENIN. *Synonym: Camphor of Elecampane. Formula, $C_{42}H_{28}O_6$.* Insoluble in water, very soluble in alcohol and ether. A. It has lately been found in Paris to act as an antiseptic.

Objections: Price too great for ordinary use.

HYDROCHLORIC ACID. *Synonym: Mariatic acid. Specific gravity, from 1.120 to 1.160. Formula, HCl .* A colorless, fuming liquid, of a

pungent suffocating odor, and corrosive acid taste. D. S. All the soluble chlorides have antiseptic properties. It is only feebly antiseptic.

HYDROCYANIC ACID. *Synonym: Prussic acid. Specific gravity, when pure, 0.7058 at 7°. Formula, C₂NH.* A thin, colorless, very poisonous and volatile liquid, with a very characteristic odor resembling that of peach blossoms. It mixes with water, alcohol and ether in all proportions. A. Belongs to Miguel's second class.

Objections: Its poisonous qualities.

HYDROGEN ACETATE. (See Acetic Acid.)

HYDRO-NAPHTHOL. A compound analogous, chemically, to phenol, having similar properties. Solid at ordinary temperature, it is very sparingly soluble in water. Its solution preserves animal tissues and fluids in the proportion of 1 to 1000.

HYPOSULPHITE SODIUM. (See Sodium Hyposulphite.)

IODINE. *Specific gravity, 4.948 at 17°. Symbol, I.* Heavy, brilliant, crystalline plates or scales, of an opaque bluish-black appearance and imperfect metallic luster. It possesses a peculiar odor similar to that of bromine and chlorine, though less penetrating. But sparingly soluble in water, requiring about 4500 parts. More soluble in glycerine.

A. D. S. A mild disinfectant, but according to Koch one of the few very active antiseptics, a 2 per cent solution killing spores within a day. Belongs to Miguel's second class.

ODOFORM. *Synonym: Teriodide of formyl. Specific gravity, 2. Formula, CHI₃.* Small, yellow, friable scales, with a sweetish taste and penetrating odor. Almost insoluble in water, but soluble in alcohol, ether, etc.

Objection: Its characteristic disagreeable odor.

IODOL. A compound very rich in iodine, of which it contains more than 80 per cent. A light-brown powder, which is seen to be crystalline under the lens. Tasteless, but having a faint odor.

A. The great advantages claimed for it are that it contains so large a per cent of iodine, and has not the disagreeable odor of iodoform.

IRON, ACETATE OF. *Synonym: Ferric acetate. Formula, (C₂H₃O₂)₃ (Fe₂).* A dark-red, uncrystallizable substance, very soluble in alcohol and water. D.

Objection: Like other acetates has feeble disinfecting qualities.

IRON, CHLORIDE OF. (See Ferric Chloride.)

IRON, SULPHATE OF. *Synonyms: Copperas, green vitriol, ferrous sulphate. Specific gravity, 1.889. Formula, FeSO₄+7H₂O.* Transparent, pale bluish-green crystals soluble in 1.8 parts of water and insoluble in absolute alcohol.

A. D. Recommended by the National Board of Health as the best disinfectant for cess-pools, stables, drains, etc.

According to Buchholtz and Andrews, arrests bacterial development in the proportion of 1 part to 100.

IRON, PERSULPHATE. *Synonym: Ferric sulphate. Formula, $Fe_2O_3 \cdot 3SO_3$.* A buff-colored, amorphous mass which dissolves slowly in water.

A. D. This salt of iron has been ranked among the best antiputrids.

Objection: According to the statement of several English writers, this substance attacks the bones.

KIRSCHWASSER. *Synonym: Cherry brandy.*

A. Cherry brandy in which nitrate of alumina has been dissolved is spoken of by Gannal as a valuable liquid for the preservation of soft objects. (See Aluminium Nitrate.)

LEAD ACETATE. *Synonym: Sugar of Lead. Formula, $Pb(C_2H_3O_2)_2 + 3H_2O$.*

Large, transparent, sweetish prisms or plates, or heavy crystalline masses. Soluble in 1.5 parts cold water and 8 parts alcohol. Disinfecting properties similar to those of the chloride, which see.

LEAD CHLORIDE. *Synonym: Plumbic chloride. Formula, $PbCl_2$.* Plates, or silky, hexagonal needles of white color.

A. D. Antiseptic in the proportion of 2.1 grammes to the litre of beef broth, according to Miguel.

Lead salts are disinfectant only as they combine with sulphur compounds to form an insoluble sulphide of lead.

Objection: The soluble salts of lead cannot be mixed with alum or corrosive sublimate.

LEAD NITRATE. *Synonym: Plumbic nitrate. Formula, $Pb(NO_3)_2$.* Colorless, transparent or opaque crystals, very soluble in water, almost insoluble in alcohol. A. D. It will not prevent the putrefaction of animal matter, but is useful as a disinfectant of putrescent animal fluids. One of Miguel's "efficient antiseptics."

LIME. *Synonyms: Quicklime, calc. oxide of calcium. Specific gravity 2.3. Formula, CaO .* White or grayish, amorphous masses, odorless and caustic. Slightly soluble in water.

D. Used in Naples, Paris and China in the coffins of the dead.

Objections: It is corrosive and only efficient when concentrated.

LIME, CHLORINATED. *Synonyms: Chloride of lime, bleaching powder.* Composed principally of calcium chloride, $CaCl_2$, and hypochlorite $(ClO)_2Ca$. A homogeneous, dull-white, granular powder, possessing the odor of hypochlorous acid. Soluble in cold water.

D. Largely used as a disinfectant. Bosquet states that there are no satisfactory facts as to the powers of the hypochlorites to destroy the infectious matter of fevers.

MAGNESIUM CHLORIDE. *Formula, $MgCl_2$.* A very deliquescent salt. It is used as one of the ingredients of Sweborn's disinfectant.

MALT SPIRIT. (See Ethyl Alcohol.)

MANGANESE SULPHATE. *Synonym: Manganous sulphate. Formula, $MnSO_4 + 4H_2O$.* Colorless or pale rose-colored crystals, very soluble in water, insoluble in alcohol.

D. Placed second by Ure in his list of disinfectants.

MERCURIC CHLORIDE. (See Corrosive Sublimate.)

MERCURIC IODIDE. *Synonyms: Red iodide of mercury, biniodide of mercury. Specific gravity 5.3. Formula, HgI_2 .* A heavy, amorphous, scarlet-red powder, or small, brilliant, octahedral crystals. It is nearly insoluble in cold water, soluble in 130 parts cold alcohol, less soluble in ether, and very little in glycerine.

A. D. S. According to Miguel, it stands at the head of the antiseptics. In the proportion of 0.025 grammes to a litre of beef broth it is able to prevent putrefaction.

MERCURIC NITRATE. *Formula, $2Hg(NO_3)_2 \cdot H_2O$.* Bulky crystals or crystalline powder.

A. D. S. According to Koch, a solution of 1 to 1000 kills bacterial spores in ten minutes.

MERCURIC SULPHATE. *Formula, $HgSO_4$.* Crystalline salt.

A. D. S. A solution of 1 to 1000 of mercuric sulphate kills bacterial spores in ten minutes, according to Koch.

MINERAL ACIDS. (See Hydrochloric Acid, Sulphuric Acid, etc.)

MORPHINE HYDROCHLORATE. *Synonym: Hydrochlorate of morphine or morphia. Formula, $C_{17}H_{19}NO_3 \cdot HCl + 3H_2O$.* White, flexible, acicular crystals, of a silky luster, or larger transparent prisms. Soluble in water, alcohol and glycerine, but insoluble in ether.

A. Has some feeble antiseptic properties.

MURIATE OF AMMONIA. (See Ammonium Chloride.)

MURIATIC ACID. (See Hydrochloric Acid.)

MYRTOL. A balsam.

A. D. By its presence it prevents the decomposition of fermentative and putrescible organic substances.

NITRIC ACID. *Synonym: Aqua Fortis. Specific gravity, 1.530, when most concentrated. Formula, HNO_3 .* A colorless, fuming, corrosive liquid.

A. S. Its chief value lies in its power to prevent the multiplication of bacteria and its low price.

NITRO-BENZOL. (See Essence of Bitter Almonds.)

NITROGEN TETROXIDE. *Synonym: Nitrogen peroxide, hyponitric acid. Formula, NO_2 .* This substance forms the greater part of the reddish-brown fumes evolved when nitrous oxide gas escapes into the air.

At 9° nitrogen tetroxide solidifies to long prisms. It is decomposed by water.

D. To the discoverer of the virtue of this substance as a disinfectant, the British government awarded the sum of £5000.

OIL OF TAR. The vapor of oil of tar is a valuable disinfecting agent, probably on account of the creasote which it contains. (See Creasote.)

ORTHO-PHENOL SULPHATE. *Synonym:* Aseptol. *Formula,* $C_6H_4H_2SO_4$. A syrupy, brown fluid, of aromatic odor, insoluble in alcohol, glycerine, and water.

A. D. F. Hueppe believes this is destined to take the place of carbolic acid as an antiseptic and disinfectant. It is not irritating in 10 per cent solution, and is an antiseptic of equal value with carbolic acid, besides having the advantage of a pleasanter odor, greater solubility, and being less irritating and toxic.

OSMIC ACID. An improper name given to the oxide of osmium. *Formula,* OsO_4 .

A. Osmic acid is placed sixth in Miguel's list of antiseptics, being at the head of his second class. It is especially valuable for albumenoids, which it coagulates.

Objection: Its vapor is intensely irritating.

OXY-MURIATE OF MERCURY. *Synonyms:* Ammoniated mercury, white precipitate, mercuric oxy-chloride. *Formula,* $HgNH_2Cl$. A white powder insoluble in water, alcohol and ether; has recently been brought into prominence by Lister as the coming antiseptic dressing.

OZONE. Ozone differs from oxygen only in its increased power of oxidation. For properties see oxygen. A. and D., presumably by its oxidation of septic matter. Turpentine and the other essential oils are by some chemists supposed to owe their antiseptic power to the fact that by exposure to sunlight they give off constantly ozone.

PALM WINE. One of the earliest of preservatives, undoubtedly owed what value it had to the alcohol which it contained.

PARAFFIN. A colorless crystalline solid, first discovered in beechwood tar, and since prepared on a large scale from bituminous shale. Paraffin is without odor or taste, is somewhat brittle and closely resembles spermaceti in appearance, fusing at 110°F. Soluble in oil of turpentine and kerosene, but generally insoluble in other menstrua. A., only as it protects from the atmosphere and bacterial germs floating therein. Has been successfully used in the preservation of meats which are immersed in melted paraffin from which they can be freed by plunging into hot water.

PEROXIDE OF HYDROGEN. *Synonym:* Oxygenated water. *Formula,* H_2O_2 . Is put upon the market in the form of a concentrated aqueous solution. *Specific gravity,* 1.452: a transparent liquid of a bitter taste

and less volatile than water. Miguel ranks peroxide of hydrogen as one of the most efficient of antiseptics (0.025 gramme for the litre), standing next in value to argentic iodide.

Objections: It is unstable and expensive and can not be combined in solution with any metallic salt. Its chief value is probably as a bleacher.

PHENIC ACID. (See Carbolic Acid.)

PHENOL. (See Carbolic Acid.)

PHENYL ALCOHOL. (See Carbolic Acid.)

PHENYLIC ACID. (See Carbolic Acid.)

PICRIC ACID. *Synonyms:* *Trinitrophenol, Trinitrophenic acid, C₆-H₃ (NO₃)₃OH.*

Properties: Brilliant, yellow, rectangular plates, intensely bitter and sparingly soluble in water but readily so in alcohol, ether and benzine. Its antiseptic properties are not very great, as it stands only seventeenth in Miguel's list.

Objections: Its sparing solubility, yellow stain which it imparts to all tissues and small preservative properties.

PISASPHALTUM. *Synonym:* *Bitumen Judaicum, or Jews' Pitch,* was an impure bituminous matter obtained from the Dead Sea, and was once largely used in embalming. (See Bitumen.)

PITCH. (See Tar.) Is an impure turpentine obtained by burning the wood of the pine tree: was in antiquity largely used to arrest alcoholic fermentation, Calabrian pitch being most highly esteemed for that purpose, but in modern times is entirely replaced by more reliable anti-ferments, except on ship board.

PLATINIC TETRACHLORIDE. *Formula:* *PtCl₄, Platinic chloride.*

Properties: Yellow needles, very soluble in water, alcohol and ether. Miguel places the chloride of platinum among his most powerful antiseptics, class two, 0.3 gramme to a litre of broth being sufficient to render it antiseptic.

Objections: High price and color.

PLUMBIC ACETATE. *Synonym:* *Acetate of lead, Sugar of lead.* *Formula,* *Pb(C₂H₃O)₂ + 3H₂O.* (See Lead Acetate.)

PLUMBIC CHLORIDE. (See Lead Chloride.)

PLUMBIC NITRATE. (See Lead Nitrate.)

POTASSA. *Synonym:* *Polash, Caustic potash, Pearl-ash.* *Formula,* *KOH.*

Properties: A deliquescent brownish, grayish or bluish solid, which is readily soluble in alcohol and in less than its own weight of water. A. and D. only as it destroys albumenoid matters for which it is an excellent solvent; hence it has been used with excellent effect in the disinfection of sewerage.

Objections: Its caustic properties.

POTASSIUM BICHROMATE. *Bichromate of potash. Formula, $K_2Cr_2O_7$.*

Properties: Large, transparent, orange red crystals (Specific gravity 2.6), which are soluble in water, but are insoluble in alcohol. A. & D. Solution of bichromate of potassium (1 to 100) has been very successfully used for arterial injection. Miguel found it efficient as an antiseptic, in the proportion of 1.2 parts to 1000 of beef broth, probably by coagulation of the albuminoids.

Objections: Its color is an insuperable objection to its use as an embalming agent, and it is, moreover, incompatible with all soluble salts of mercury, lead, silver and zinc.

POTASSIUM CHROMATE. *Yellow Chromate of Potash. Formula, K_2CrO_4 .*

Properties: Yellow, anhydrous crystals of a cool, bitter, disagreeable taste, more readily soluble in water than the bichromate. A. & D. According to Miguel, efficient as an antiseptic in the proportion of 1.3 parts to 1000 of beef broth.

Objections: Its color, like that of the bichromate, is the most serious obstacle to its use as an antiseptic.

POTASSIUM CYANIDE. *Cyanide of Potash. Formula, KCN.*

Properties: A white deliquescent salt, odorless when dry, but having a peach-leaf odor when moist. It is readily soluble in water and sparingly so in alcohol, if strong; more so in weak alcohol. A. & D. One of the weakest of the antiseptics, for according to Miguel it requires 165 grammes to the litre to prevent putrefaction in beef broth.

POTASSIUM HYDRATE. (See Potassa.)

POTASSIUM IODIDE. *Iodide of potash, Iodide of potassa. Formula, KI.*

Properties: Potassium iodide is a semi-opaque, crystalline solid, permanent in dry air, but somewhat deliquescent in moist. It has an acrid, saline taste and is readily soluble in water and alcohol. A & D. Potassium iodide is one of the feeblest of the antiseptics, according to Miguel, requiring as much as 150 parts to 1000 to prevent the development of bacteria.

Objections: High price and slight efficiency.

POTASSIO-MERCURIC IODIDE. *Double iodide of mercury and potash.*

Preparations: $3\frac{3}{4}$ grains of mercuric iodide will exactly combine with $2\frac{1}{2}$ grains of potassium iodide to form this salt of mercury, which is most conveniently preserved in solution. It can, however, be isolated and appears as a yellow, crystalline salt which is soluble, especially so in solutions of potassium iodide, or of corrosive sublimate. A. & D. It is claimed that this salt is more efficient than corrosive sublimate, and is worthy of more extended trials.

POTASSIUM BICARBONATE. *Acid carbonate of potash. Formula, $KHCO_3$.*

Properties: Transparent, colorless crystals, inodorous, and of a slightly alkaline taste. They are soluble in water, but insoluble in alcohol, and have slight disinfectant properties.

POTASSIUM NITRATE. *Nitrate of potash, Saltpetre. Formula, KNO_3 .*

Properties: Large, transparent, colorless crystals, which are odorless, but having a sharp, cooling taste, and are soluble in water. Nitre is one of the oldest of the preservatives, and is especially valuable for its power of restoring the normal red color to dead muscle, on which account it is largely used by packers in the preservation of meat; but for all other purposes it has been well replaced by more efficient antiseptics.

POTASSIUM PERMANGANATE. *Permanganate of potassa, Hypermanganate, Symbol, $K_2Mn_2O_8$.*

Properties: Slender, prismatic crystals without odor, but having a sweetish, astringent taste. Permanganate of potassium is immediately decomposed by alcohol but dissolves readily in water forming a beautiful solution.

A. & D. If it were not for its coloring all tissues with which it is brought in contact, this salt would be one of the most largely used of the antiseptics, for according to Miguel $3\frac{1}{2}$ parts to 1000 are sufficient. It is also valuable as a disinfectant, a few drops of 1 per cent solution thoroughly disinfecting 10 c.c. of normal beef solution. (1:10).

Objections: Color and the ease with which it is oxidized, for permanganate of potassium can hardly be preserved in any other solvent than pure distilled water.

POTASSIUM PRUSSIAN. *Yellow prussiate of potash, Potassium ferrocyanide, $K_4Fe(CN)_6 \cdot 3H_2O$; Atomic weight, 421.9.*

Properties: Large yellow translucent crystals which are tough and flexible and undergo no change by exposure to the atmosphere. Ferrocyanide of potassium is soluble in 4 parts of water, but is not dissolved by alcohol.

A. & D. Its antiseptic powers are feeble according to Miguel as much as 185 grammes being requisite to preserve a litre of beef broth.

Objections: Color and feeble antiseptic properties.

POTASSIUM SULPHOCYANIDE. *Sulphocyanide of potash, Thiocyanide.*

Properties: White deliquescent crystalline substance, very soluble in water and also in alcohol.

A. & D. It has feeble antiseptic properties, requiring, according to Miguel, as much as 120 grammes to the litre to render beef broth antiseptic.

Objections: Very poisonous and inefficient.

PROPYL ALCOHOL. *Propionic alcohol. Formula, C₃H₇OH.*

Properties: Normal propyl alcohol is an oily liquid with a disagreeable odor, soluble in water, but not in all proportions as is ordinary alcohol. Specific Gravity 0.79.

A. & D. It is said by some to be a better antiseptic than ordinary alcohol, but further experimentation is needed to establish its actual value.

Objections: Its vile odor.

PYROACETIC ACID. (See Wood Naphtha.)

PYROLIGNEOUS ACID. Is not a definite chemical compound, but a mixture of many obtained by the distillation of wood for the purpose of preparing wood vinegar and acetic acid. It is a dark, pungent liquid with an empyreumatic odor and disagreeable taste.

A. & D. The antiseptic value of pyroligneous acid is probably largely due to the creasote which it contains; many cases are reported in which animal matter has been successfully preserved by the use of the crude acid. (See Creasote.)

Objections: The unpleasant odor of pyroligneous acid and its less efficiency than the creasote contained in it.

QUININE. *Quinia, quinia, chinium. Formula, (C₂₀H₂₄N₂O₂ + 3H₂O); 1378.*

Properties: A well known white crystalline, flaky powder, slightly efflorescent on exposure. It has a slightly alkaline reaction, and is soluble in about 1,600 parts of cold water, 700 boiling, or 6 parts cold alcohol. It is also dissolved by ether, chloroform, carbon bisulphide, benzol, and ammonia water.

A. & D. Andrews and Buchholtz's experiments shows that quinine ranks next to carbolic acid as an antiseptic. According to Koch a 1 to 2 per cent solution of quinine will kill in six to eight days the lower forms of life. It is also feebly disinfectant.

Hydrobromate of quinine was the salt tested by Miguel and he reports it as standing at the head of the moderately antiseptic substances requiring 5½ grammes to the litre.

Objections: The high price of the alkaloid and its moderate value as an antiseptic are against its general use.

QUINOLINE-CHLORAL AND QUINALINE-RESORCIN were some years ago proposed as reliable antiseptics, but aside from a reference to their use for this purpose in the New Remedies for 1869, page 168, we can find no account of their properties or value. They are derivatives of chinoline, C₉H₇N₁₁ a coal tar alkaloid, but none of the standard works on organic chemistry give any description of these substances.

RESINS, from the time of the Egyptians have largely been used for

their preservative properties, for it has been known from time immemorial that resinous woods, such as cedar, do not decay rapidly, and hence they were used in early times for coffins by the rich, and pine boughs and needles in their graves by the poor. The value of these resins largely depends upon the essential oils which they contain and which are now substituted for them. (See Turpentine, Cedar, etc.)

SALT OF ALEMBROTH. (See Ammoniated Mercury and White Precipitate.) As has already been said under the head of ammoniated mercury, this salt is by some considered the coming antiseptic. One of these is Sir Joseph Lister, to whom antiseptic surgery owes so much. Carbolic acid was at first his favorite; later it was superseded by corrosive sublimate, and this has latterly been entirely displaced by sal alembroth for surgical dressings. It is prepared by the sublimation of a mixture of mercuric chloride and muriate of ammonia, and is used by Lister in 1 to 100 solution either on cotton, wool, lint or bandages soaked in this solution and dried before using.

SAL AMMONIAC. (See Ammonium Chloride.)

SALICYLIC ACID AND THE SALICYLATES. Are obtained either from oil of wintergreen, which contains methyl salicylate, or from carbolic acid by sending a current of carbonic acid gas through it. Salicylic acid $(HO)CO(OH)(C_6H_4)$ occurs in white, prismatic crystals which are freely soluble in alcohol, ether and hot water, but only very sparingly in cold. (1 to 1800.)

A. & D. Salicylic acid is an excellent antiseptic for the preservation of milk and liquids, but its use for the preservation of meat has been disappointing, for after the lapse of a few days an unpleasant odor is developed, which, however, is not that of putridity. Buchholtz's experiments prove that salicylic acid has the power of arresting bacterial development in the proportion of 1 part to 666, and Miguel's tables show that one gramme to the litre will preserve beef broth from putrefaction.

Objections: Its sparing solubility and the unpleasant odor frequently evolved, unless the acid is brought in contact with all parts of the tissues by injection. On the other hand, salicylic acid is comparatively cheap and stable, odorless and not poisonous. The salicylates have about the same properties as the salicylic acid except that they are more readily soluble in water and are efficient in the proportion 1 to 100.

SILVER IODIDE. (*synonyms: Argentio Iodide, Iodide of Silver.*)
Symbol, AgI.

Properties: A pale yellow salt, nearly insoluble in water and also in aqua ammonia, wherein it differs from the other salts of silver. Soluble in concentrated aqueous solutions of common salt or chloride of potassium.

A. & D. Miguel places the iodide of silver as the second on his list

of very powerful antiseptics, according to his experiments arresting bacterial development in the proportion of 0.03 parts to a thousand.

Objections : Sparing solubility and change of color with light.

SILVER NITRATE. (*Synonyms :* *Argentie Nitrate, Nitrate of Silver, Lunar Caustic, Symbol* $AgNO_3$.)

Properties : Anhydrous, transparent crystals, or, when fused, white, translucent masses (specific gravity 4.32), when perfectly pure it is not acted upon by light, but in contact with organic matter rapidly blackens. Soluble in 0.8 parts of water and 26 parts of alcohol at 59°F.

A. & D. Nitrate of Silver, according to Miguel, stands fifth in his list of powerful antiseptics, 0.08 parts to 1,000 being sufficient to prevent putrefaction in beef broth.

SMOKE. (See Creasote.)

SODA. *Caustic soda, soda, lye, sodic hydrate. Formula, NaOH.*

Properties : A hard, white substance, very deliquescent but later becoming dry from the absorption of carbonic anhydride from the atmosphere. Caustic soda is readily soluble in cold water (1 to 1.7) and more so in hot.

A. & D. Caustic soda is placed by Miguel among his moderately antiseptic substances, 18 grammes being required to arrest putrefaction in a litre of beef broth.

SODIUM ACETATE. *Acetate of soda, sodii acetat. Formula, NaC₂H₅O.*

Properties : Large, colorless, transparent prisms which are soluble in water and alcohol.

A. & D. Like all soluble acetates, acetate of soda has feeble antiseptic powers.

SODIUM ARSENIATE. (*Synonyms :* *Arseniate of soda, Sodii arsenias, Symbol, Na₂H AsO₄+7H₂O; Atomic weight; 311.9.*

Properties : Colorless, transparent crystals containing 40% of water of crystallization. They effloresce slightly in dry air and are soluble in 4 parts of water and but sparingly so in cold alcohol.

A. & D. Arseniate or arsenite of soda, as it is frequently called, has long been used as an arterial injection in the proportion of one pound to a gallon of water. Nine parts to a thousand, according to Miguel, acts as a moderately efficient antiseptic, being sufficient in this proportion to prevent putrefactive changes in beef broth.

SODIUM BENZOATE. *Benzoate of soda, sodii benzoas, NaC₇H₅O₂+H₂O.*

Properties : Colorless needle-shaped crystals which are odorless or have a faintly aromatic odor. They are freely soluble in cold water (1 to 1.8) or alcohol, and still more so in boiling water or alcohol. Not poisonous.

A. & D. According to Andrews and Buchholtz, sodium benzoate is

quite efficient to arrest bacterial development, a solution as weak as one part to 2000 being sufficient for that purpose.

SODIUM BICARBONATE *Sodii bicarbonas.* *Formula,* NaHCO_3 . *Molecular weight, 84.*

Properties: White opaque masses which are permanent in the air and soluble in 11.3 parts of water at ordinary temperatures, but insoluble in alcohol.

A. & D. The chief value of bicarbonate of soda to the embalmer seems to be as a disinfectant, for which purpose it is highly recommended by Dr. Muscroft.

SODIUM CHLORIDE. (*Common salt, muriate of soda.*) *Formula,* NaCl . *Properties:* The properties of common salt are too well known to need any extended description here. It is almost equally soluble in water at all temperatures (35.39 parts to 100); also soluble in glycerine, but not in alcohol, ether or chloroform.

A. & D. The use of brine as a preservative has been practiced from the earliest times, but modern investigations prove that it is one of the weakest of the antiseptics, Miguel classing it as only slightly antiseptic, for it requires as large a proportion as 165 parts to 1,000 to exercise its preservative powers in beef broth. Tidy suggests that its antiseptic properties are due to its power of extracting water from the tissues.

Advantages: Cheapness and ready solubility.

SODIUM HYPOCHLORITE. See Labarraque's Solution.

SODIUM HYPOSULPHITE. *Sodii hyposulphitis, sodium thiosulphate.* *Preparation:* This salt can be prepared by mixing finely powdered carbonate of soda with flowers of sulphur, and heating in a porcelain dish, with constant agitation until it takes fire. The residue is then dissolved in water and boiled with sulphur and evaporated to dryness. As thus prepared it forms large transparent crystals (Specific gravity 1.7), readily soluble in water and turpentine, but not in alcohol.

A. & D. Sodium hyposulphite at one time enjoyed quite a reputation as a preservative, it having been successfully employed by Suequet in his famous competitive trial (see page 47.) and in saturated solution will undoubtedly preserve bodies for months, but it is not the best of our antiseptics, for according to Miguel's experiments it requires 265 grammes to a litre to prevent putrefaction in beef broth.

SODIUM SALICYLATE. (See Salicylic Acid.)

SODIUM SILICATE. *Silicate of soda, soluble glass, Verre soluble.* *Properties:* As ordinarily seen, it is put upon the market in the form of an aqueous solution, prepared by fusing sand and sodium carbonate together, and digesting in water. This solution is a viscid fluid of a yellowish hue, and on evaporation leaves behind a glassy film, which is entirely unacted upon by the air. This property has suggested its use as

an antiseptic, and possibly the substance was known in the days of Herodotus, for he informs us that the Macrobianus dried their dead before a slow fire, then coated them with stucco or chalk and covered the whole with glass. (Book 3.)

A. & D. Mildly antiseptic, for it seems to have some power of arresting vinous fermentation, and by Richardson is highly recommended as an injection, after one of chloride of zinc, to harden the body.

SODIUM SULPHATE. *Sulphate of Soda, Glauber's salt*, $\text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$.

Properties : Large, colorless, transparent crystals (Specific gravity 1.48,) containing more than fifty per cent of water of crystallization. They are very soluble in water, and also in glycerine, but not in alcohol.

A. & D. Sulphate of soda has, like nitre, somewhat remarkable preservative properties, for many of the so-called natural mummies are found in caves whose soil and atmosphere are saturated with sulphate of soda. (See page 30). Very inefficient as an antiseptic. (See Miguel's table.)

SPICES were used by the Egyptians, Romans, and Hebrews in the embalming and preservation of their dead, and hence undoubtedly are the most ancient of antiseptics and disinfectants. The body of Jesus was wound "in linen cloths with spices, as is the manner of the Jews—a mixture of myrrh and aloes about a hundred weight." A. & D. The value of spices as a preservative depends on the essential oils contained in them. (See Essential Oils.)

STORAX. *Synonym*: *Styrax*. The balsamic juice obtained from the *Liquidambar orientale*, or "sweet gum." It is a source of benzoic acid.

STRYCHNIA. *Synonym*: *Strychnine*. *Formula*, $\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2$. Small, brilliant, colorless, transparent or white crystals, permanent in the air. It is soluble in 6700 parts of water, and 110 parts of alcohol at 15°. More soluble in chloroform. A. & D. According to Miguel, sulphate of strychnia will prevent putrefaction in the proportion of seven grammes to the litre of normal beef broth. Hence placed by him among "moderate antiseptics." According to Schutzenberger, nux vomica (the source of strychnia) does not retard vinous fermentation, but prevents putrefaction.

SUGAR AND SYRUP. *Synonyms*: *Saccharose, Cane sugar*. *Specific gravity*, 1.606. *Formula*, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$. Small, white prisms, or large, yellowish, transparent crystals. It is very soluble in water, dissolving in about one-third its weight of cold water, and more abundantly in hot water. It is insoluble in absolute alcohol or ether. A. Its antiseptic power is probably due to its property of extracting water from various organic substances. A cane-sugar syrup is largely used as an ingredient of the various preservative fluids.

SUGAR OF LEAD. (See Lead Acetate.)

SULPHATE OF ALUMINIUM, IRON, ETC. (See Aluminium Sulphate, Iron Sulphate, etc.)

SULPHITE OF SODIUM. A colorless salt having the formula, $Na_2SO_3 + 7H_2O$. Its action is very similar to that of the hyposulphite. (See Sodium Hyposulphite.)

SULPHUR. *Specific gravity, 2.07. Symbol, S.* An element occurring both free and combined in nature. It occurs in yellow, transparent crystals in the form of rhombic octahedra. Sulphur is insoluble in water and most organic liquids, but freely soluble in carbon disulphide. A. & D. It is perhaps the earliest of the disinfectants. Ulysses is represented as ordering fire and sulphur to be brought to purify the dwelling which had become infected by the dead. Pliny also speaks of a religious exercise having for its object the purification of houses by the burning of sulphur.

According to the National Board of Health, roll sulphur is the best disinfectant for fumigation, and should be fired in iron pans standing in tubs containing a little water, the room being kept tightly closed for twenty-four hours.

Burning sulphur evolves sulphurous acid, which is one of the best disinfectants.

SULPHURIC ACID. *Specific gravity, 1.8426. Formula, H_2SO_4 .* A dense, colorless, highly corrosive liquid, having a strong attraction for water, and drawing it or its elements from organic compounds immersed in or mixed with the acid. It dissolves most of the metals, forming their sulphates.

A. D. S. According to Buchholtz and Andrews, it has antiseptic properties in the proportion of 1 to 151. Koch, however, found a sulphuric acid solution absolutely incapable of killing splenic fever spores.

SULPHUROUS ACID. A colorless liquid, possessing the characteristic suffocating odor of burning sulphur, obtained by saturating water with sulphur dioxide gas, SO_2 . It first reddens and then bleaches vegetable colors, but without destroying them.

A. & D. Said to have the least effect of any of the inorganic acids on infusoria, though considerably used as medicine in diphtheria, etc. It is a good antiferment, good for bleaching, and not poisonous.

Objections: Not cheap; unpleasant and unstable; evolves sulphuretted hydrogen with decomposing tissues.

TANNIC ACID. *Synonym: Tannin. Formula, $C_{14}H_{10}O_9$.* Amorphous, friable, porous and inodorous masses, or thin shining scales of a pale, greenish-yellow color, and feeble, mild odor.

Tannic acid is soluble in six parts of water or glycerine, and in less than its own weight of diluted alcohol.

A. The preservative effects of tannic acid seem to be chiefly exerted upon the skin, which it converts into an imputrescible leather, but does not seem to have any effect upon muscular tissues.

TANNIN. (See Tannic Acid).

TARTAR EMETIC. *Synonyms: Antimonii et potassæ tartras. Tartarized antimony, Antimony tartrate.* *Specific gravity, 2.5.* *Formula, $K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$.* It occurs in colorless, transparent crystals, or a white, granular powder. A. This substance is used by Mr. Latur and others as one of the ingredients of their preservative fluids.

TEREBENTHENE. *Specific gravity, 0.8767.* *Formula, $C_{10}H_{16}$.* A colorless, mobile liquid, obtained from oil of turpentine, having its peculiar odor. According to Koch it is efficient as an antiseptic in the proportion of 1 to 70000.

THYMOL. *Synonym: Methyl-propyl-phenol.* *Formula, $C_{10}H_{14}O$.* Large, transparent, colorless crystals, having an aromatic odor, a pungent aromatic taste, and neutral in their action on litmus paper. A. & D. Thymol is spoken of by Koch as one of the few reliable antiseptics, and Buchholtz and Andrews' experiments seem to show that it is reliable in as weak a solution as 1 to 2000. It is placed by Miguel in his third class of "powerful antiseptics."

TIN CHLORIDE. *Synonyms: Protochloride of tin, Stannous chloride, Tin crystals.* *Formula, $SnCl_2 + 2H_2O$.* A crystalline salt obtained by dissolving tin in hydrochloric acid.

TRINITROPHENOL. (See Picric Acid.)

TURPENTINE. *Synonyms: Essence of turpentine, Spirits of turpentine.* *Specific gravity, 0.86.* The volatile product of the distillation of turpentine. A colorless, neutral, limpid liquid. The essential oils are chemically identical with turpentine, therefore it is one of the oldest of chemical preservatives, for embalming by the Egyptians depended largely upon the essential oils contained in spices. According to Gannal, essence of turpentine can only serve for small pieces; it is not easily transported, alters several of the tissues, and becomes thick and clouded.

VINEGAR. (See Acetic Acid). Celsus writing in the first century of our era, insisted upon the value of vinegar in the time of epidemics, as did other writers of antiquity.

WHITE ARSENIC. (See Arsenious Acid.)

WHITE VITRIOL. (See Zinc Sulphate.)

WOOD NAPHTHA. *Synonyms: Acetone, Pyroacetic spirit.* *Specific gravity, 0.7921.* *Formula, C_3H_6O .* A limpid, colorless liquid, soluble in water, alcohol and ether. A. Owing to its cheapness, pyroxylic spirit has been extensively used in England as a substitute for alcohol in the arts and manufactures.

ZINC CHLORIDE. *Formula, $ZnCl_2$.* A colorless, coherent, granular powder, or colorless, opaque rods or fragments, very deliquescent and caustic. It is soluble in water, glycerine, alcohol, and ether. A. & D. Chloride of zinc, when strong, coagulates albumen, and absorbs ammonia and sulphureted hydrogen. It is largely used in disinfecting fluids. In any ordinary solution Koch found it absolutely incapable of killing the spores of splenic fever. While it destroys putrid odors, it has no smell of its own. Chloride of zinc seems to act by its union with the water of the tissues, from which the water is extracted. From that time the preservative power diminishes.

ZINC SULPHATE. *Synonyms: Sulphate of zinc, White vitriol.* *Formula, $ZnSO_4 + 7H_2O$.* This substance occurs in colorless, transparent crystals, or acicular needles. It is readily soluble in water and glycerine, but insoluble in absolute alcohol. A. & D. One of the feeblest antiseptics. A solution of zinc sulphate and common salt has been highly recommended for the disinfection of clothing, bed linen, etc. Koch tested the power of white vitriol to kill the spores of splenic fever, but found it incapable of so doing.

Objections: It cannot be mixed with alkalies, earths, bicarbonates, sulphides, lime-water, or vegetable astringents.

DEODORIZING AGENTS AND METHODS.

Chloride of zinc.

Corrosive sublimate.

The hyposulphites.

Oxymuriated mercury.

Carbolic acid.

Bicarbonate of potash.

Alumina salts.

Eklund's method, recently advocated, as the simplest to arrest putrefaction, is to inject a saturated solution of common salt, with a little depurated "ferrie acid" and boracic acid, into the arteries of cadavers. In cases of death from infectious diseases, it would be advisable to inject first a solution of biniodide of mercury, or of bichloride of mercury, dissolved in a hot solution of iodide of potassium, this again in alcohol, or a solution of chloride of ammonium or common salt. The trunk and extremities of the cadaver should be wrapped with a layer 5 to 8 millimetres thick, of lime packed into long flat bags that can be wrapped like a belt around those parts.

It would also be desirable that the police ordinances relating to the burying of the dead contain provisions with a view to enforcing the following features: That the bottoms of coffins be made impermeable to water, and be covered with a layer 5 to 8 millimetres thick, of substances possessing absorbent properties, such as dry earth, the crushed acicular

leaves of resinous trees, ashes, saw-dust, and charcoal dust. Just before closing the coffin the hands and face should be covered with lime.

Another method is that proposed by one Jacob Reese who thinks that all animal substances can be indefinitely preserved in air-tight steel casks provided they be packed therein under pressure of 80 pounds to the inch, and at the same time injected with a three per cent solution of boracic and tartaric acid with a little common salt.

Architect Baumann's magnificent project for the city of Chicago is to "erect a monster edifice, resembling the ancient Tower of Babel, with a gradual ascending stairway, which might be carried to any height desirable, from twenty-five to fifty stories high. The structure should be architecturally beautiful and classic in design, and built of solid masonry. Thousands of vaults could be arranged in this building, which could be sold or rented to parties for single interments or for the accommodation of families. The wall of each department should be of stone, with ornamental entrances, and the entire building hollow to the sky.

At all times a huge fire is to be kept burning in the basement of this hollow center, which would effectually destroy all the poisonous vapors and gases which might arise from the process of human decomposition. All that is required to carry out this scheme, the enthusiastic inventor claims, is an act of incorporation and \$500,000; and then Chicago could vie with Egypt in the magnificent and colossal character of the pyramidal mausoleum."

Possibly this might be conjoined with "Judge Hulett's" cementation method, which consists in imbedding the naked body in cement, whose advantages, as set forth in the inventor's language are as follows:

"An unvitriified mineral coating around a dead body of four inches in thickness will confine the gases produced by decomposition for from one to two months before any diffusion of the gases through the pores of the covering is perceptible; and by the sluggish filtration but small quantities can be discovered at any given time unless confined.

"This mode of cementing the dead will give double the capacity to our cemeteries, as the space now occupied by one may contain two bodies, one upon the other.

"To sum up the whole matter, we say: First, the cementation of the dead is economical in every point of view. Second, it possesses all the sanitary protection that is requisite to the health of the living. Third, it brings mortality to the same level before burial that it will assume after by uniformity of process. Fourth, it forever preserves form and features, as no other process possibly can. The latter may be regarded as a myth, but no more so than to fill our dwellings with sculpture, paintings, and photographs of the dead, mere shadows of the real, while the positive features of our dead have been positively rescued from destruction

from any causality (subject to inspection, should we so desire) by this process of cementation. ”

Which of these may be the method of the future is unprofitable to speculate, but doubtless in the coming years there will be improvements on our present methods. And among these will be the discovery of improved bleaching agents, for the list at present is meager, and the action of many of those most used is uncertain and disappointing.

BLEACHING AGENTS.

STRONG PHENOL. In an alcoholic solution of corrosive sublimate.

POWDERED CHLORAL

PEROXIDE OF HYDROGEN.

BROMINE WATER.

CHLORINE WATER.

CHLORIDE OF LIME. Followed by oxalic acid.

SULPHITE OF SODA. Strong solution, followed by oxalic acid.

WHITE WINE VINEGAR; must not be used on the lips as it turns them black; otherwise excellent.

HOT WATER. Must not be used in dropsical cases; otherwise good. (S.)

STRONG ACETIC ACID.

PYROLIGENOUS ACID. Afterwards wash with warm water.

STRONG SALT BRINE, etc.

PROPRIETARY AND PATENT PRESERVATIVES AND METHODS

are almost legion in number, and unsatisfactory in results. No systematic examination of these has yet been made, but like other patent preparations they are all made first to sell, and second to benefit, if possible, the purchaser. Among the best of these proprietary antiseptics are

CONDY'S FLUID,

which is a solution of the manganates and permanganates of soda, which see.

SIR WM. BURNETT'S SOLUTION

contains 15 ounces chloride of zinc to 1½ gallons of distilled water. It is prepared by dissolving zinc in muriatic acid to saturation, and then diluting as above. It was patented in 1840, and is still one of the most reliable fluids for the preservation of animal and vegetable substances, which should be immersed in it for two or three days and then left to dry in the air.

BROMO-CHLORALUM, '

is the name given by the Tildens to a solution of the chloride of aluminium, which was first introduced as a disinfectant by Professor Gamgee, although it had previously been tried by Gannal. (See Aluminium Chloride.) Probably a waste product of chemical manufacture. Composition of chloralum, according to one analysis is

Aluminium Chloride,	20 ounces.
Calcium Sulphate,	$\frac{1}{3}$ "

Bromo-chloralum, contains aluminium, with traces of calcium sulphate, according to another analyst.

LABARRAQUE'S DISINFECTING SOLUTION.

Prepared as follows:

Chloride of Lime,	1 pound.
Carbonate of Soda,	2 pounds.
Water	$1\frac{1}{2}$ gallons.

Dissolve the carbonate of soda in three pints of water by the aid of heat; to the remainder of the water add, by small portions at a time, the chloride of lime previously well triturated, stirring the mixture after each addition: set the mixture by for several hours that the dregs may subside, then decant the clear liquid and mix it with the solution of carbonate of soda. Lastly, decant the clear liquor from the precipitated carbonate of lime, pass it through a linen cloth and keep it in bottles secluded from the light.

It is a colorless alkaline solution, having a faint odor of chlorine, and an alkaline taste; it owes its antiseptic properties to containing hypochlorous acid, which is readily liberated by the addition of even a weak acid and, on exposure to the air, by the absorption of carbonic acid.

Commercial Labarraque's solution contains about two ounces available chlorine to the gallon. According to Duggan the hypochlorites are the only safe disinfecting agents for discharges containing albuminous matter.

LEDOYEN'S DISINFECTING FLUID,

which is greatly esteemed abroad, is a solution of nitrate of lead in water in proportion to two ounces of the salt to one pint of water, and may be prepared by dissolving $13\frac{1}{2}$ oz. litharge in 12 oz. nitric acid, and diluting with water to 6 pints.

EAU DE JAVELLE

is a solution of the hypochlorite of potassium and hence is very similar in its action to Labarraque's solution, which contains the hypochlorite of sodium.

ENGLISH PATENT DISINFECTANTS.

The following is a list of those exhibited at the recent International Health Exhibition at London:

Sharp & Co's. Disinfectant.

Austin's Antiseptic.

Tuson's Disinfectants, Liquid and Powder.

Thymo Cresol.

Concentrated Carbolated Creasote Disinfecting Fluid.

Calvert's Phenol and Disinfecting Powders.

Jey's Perfect Purifier Disinfectant.

Sanitas Disinfectant. (See Formula No. 93.)

Affinitas Chlorozone.

Condy's Fluid. (See Page 564.)

Billings' Thymol Disinfecting Fluid.

New Carbolic Sanitary Company Products.

Antimicrobe.

McDugall's Carbolic and Sulphurous Disinfectant.

Overbarry's Sulphur Disinfectant.

Clutterbuck's Chemical Closet Cleaner.

Oxychlorogene Chloro-Manganese.

Epulixon.

Sanitizer Camphorein.

Eucalyptozone.

Pixene Crimson Salt Company.

Ferralum.

Cupralum.

Ellerman's Disinfectant.

Larmande's Antimephitic Powder.

Eau De Javelle. (See page 565.)

Grantsville Carbolic Alkali.

Phenol Sodique.

Collins' Disinfecting Powder.

Little's Soluble Phenyl.

Liquor Zinci Chloridi. (Squibbs.)

Feuchtwanger's Disinfectant.

To the above may be added those of more or less frequent use in this country, viz.:

Platt's Chlorides. (Formula 75.)

Girondin Disinfectant. (Formula 86.)

Williamson's Sanitary Fluid. (Formula 86.)

Bromo-Chloralum. (See page 565.)

Blackman's Disinfectant.

Burkhardt's Disinfectant.

"Listerine."

"Omnico."

Styrium, United States Trade Mark, 12,786.

Inodorine, United States Trade Mark, 12,784.

Camphorine, United States Trade Mark, 12,481.

E. G. Washburn Fluids, Springfield, Mass.

G. M. Rhodes' Fluid, Grand Rapids, Mich.

Mills & Lacey Fluid, Grand Rapids, Mich.

Clarke Chemical Fluid, Springfield, Ohio.

Champion, Springfield, Ohio.

B. F. Ray Fluid, Utica, N.Y.

Johnson & Shaw Fluid, Boston, Mass.

Crane & Allens.

Egyptian Embalmer.

Corpus Balsaming.

GENERAL CONCLUSIONS.

But it would be useless to further multiply the list for there barely remains sufficient space for a few general conclusions, viz.:

I. "Disinfection is the destruction of the poisons of infectious or contagious diseases. Deodorizers are not necessarily disinfectants, and disinfectants do not necessarily have an odor: . . . and no reliance can be placed on disinfectants simply because they smell of chlorine or carbolic acid, or possess the power of permanganates." . . . In general, proprietary disinfectants with high-sounding names are practically worthless." Chandler.

II. The disinfecting power of any antiseptic is in inverse proportion to the age of the putrefying materials; *e. g.*, meat to be kept six days needs ten times less than that to be kept sixty days.

III. There is no parallelism between the disinfecting action of an antiseptic and its action on microbes; *e. g.*, potassic permanganate has no action on the last, but is the most powerful disinfectant.

RELATIVE VALUE OF THE DIFFERENT SPORICIDES.

This subject has been carefully studied by different methods, and with somewhat different results by Dr. Koch and Dr. Miguel. Koch's method was to employ rabbits sick with anthrax whose organisms are found in the form of minute, round micrococci spores, which afterward develop, under favorable conditions, into slightly larger rod-shaped bodies or bacilli. It was found, though this was indeed already known, that its spores had a much greater vital resistance than the bacilli.

From Koch's careful investigations, he concludes that the only certain sporicides are chlorine, bromine, and corrosive sublimate; and that to arrest development only corrosive sublimate, certain ethereal oils, thymol and allyl-alcohol are available. Bromine vapors are recommended for confined spaces. Chlorine is a little less satisfactory, but more so than formerly supposed. In all cases where neither heat nor gases are available, corrosive sublimate, and indeed all mercurial salts are recommended.

A solution of 1 to 1000 of the mercuric chloride, sulphate or nitrate, kills the resisting spores in ten minutes; and, indeed, simple moistening of the earth containing the spores with this solution is sufficient to arrest their power of development. Solutions of 1 in 1000 to 1 in 15000 are sufficient to kill micro-organisms. The poisonous action of such diluted solutions may be disregarded. The cost also is far below that of carbolic acid.

Koch tested the power of sulphuric acid, chloride of zinc, borax, white vitrol, and other substances. He found them absolutely incapable, in any ordinary solution, of killing the spores. Such substances as arsenic, quinine, and perchloride of iron would, in one or two per cent solution, kill the organisms in the course of six or ten days, but were, on the whole, quite feeble disinfectants.

On the other hand a few substances only were found to be very active. Thus, two per cent solutions of bromine, iodine and chlorine and of corrosive sublimate (the last being the best) killed the spores within a day. The power of these latter substances to prevent the activity and development of the bacilli was found to be very remarkable. Thus, 1 part of sublimate in 500,000 of water would completely check the activity of the organisms. Certain volatile oils, such as oil of thyme and terebenthene, were also efficient in dilutions of 1 to 80,000 and 1 to 70,000. And further, as one of the results of his experiments, Koch came to the conclusion that only bromide, chlorine, iodine and corrosive sublimate, and the few oils of the class referred to, were of value as disinfecting agents.

BUCHHOLTZ AND ANDREWS' EXPERIMENTS.

According to these investigators, the substances given below arrest development in bacterial solutions when added in the following proportion:

1. Corrosive sublimate.....	1,20,000
1. Thymol	1,2,000
3. Sodium benzoate.....	1,2,000
4. Creasote	1,2,000
5. Benzoic acid.....	1,1,000

6. Salicylic acid.....	1.666
7. Eucalyptol.....	1.666
8. Chloral hydrate.....	1.400
9. Carbolic acid.....	1.200
10. Quinine.....	1.200
11. Arsenic.....	1.166
12. Sulphuric acid.....	1.151
13. Boracic acid.....	1.133
14. Cupric sulphate.....	1.100
15. Ferrous sulphate.....	1.100
16. Hydrochloric acid.....	1.75
17. Zinc sulphate.....	1.50
18. Alcohol (Ethyl).....	1.50
19. Boro-glycerine.....	1.50
20. Glycerine.....	1.4 $\frac{1}{2}$
21. Hyposulphite of soda.....	1.4

Miguel's table does not exactly agree with Buchholtz's, but for purpose of comparison is also given in parts to a thousand.

MIGUEL'S TABLE.

Biniodide of mercury.....	0.025
Iodide of silver.....	0.03
Oxygenated water.....	0.05
Bichloride of mercury.....	0.07
Nitrate of silver.....	0.08
Osmic acid.....	0.15
Chromic acid.....	0.20
Iodine.....	0.25
Chlorine.....	0.25
Hydrocyanic acid.....	0.40
Bromine.....	0.60
Chloroform.....	0.80
Sulphate of copper.....	0.90
Salicylic acid.....	1.00
Benzoic acid.....	1.10
Chromate of potassium.....	1.30
Picric acid.....	1.30
Ammonia gas.....	1.40
Thymic acid.....	2.00
Chlorides of lead, cobalt and nickel.....	2.10
Mineral acids.....	2.00 to 3.00
Nitrobenzine.....	2.60
Essence of bitter almonds.....	3.00

Carbolic acid.....	3.20
Permanganate of potassium.....	3.50
Aniline.....	4.00
Divers alums.....	4.50
Tannin.....	4.80
Sulphydrate of sodium.....	5.00
Arsenious acid.....	6.00
Boric acid.....	7.00
Hydrate of chloral.....	9.50
Salicylate of soda.....	10.00
Sulphate of the protoxide of iron.....	11.00
Amylic alcohol.....	14.00
Sulphuric ether.....	22.00
Butylic alcohol.....	35.00
Propylic alcohol.....	60.00
Borate of soda (borax).....	70.00
Ethylic alcohol.....	95.00
Sulphocyanide of potassium.....	120.00
Iodide of potassium.....	140.00
Prussiate of potash.....	185.00
Glycerine (officinal).....	225.00
Urea (natural).....	260.00
Hyposulphite of soda.....	275.00
Chlorate of soda.....	400.00

N. B. Table given above indicates in grammes the quantities required to make imputrescible one litre of beef tea.

II. BIBLIOGRAPHY.

The following alphabetical list from Paulet's *Conservation des Bois* gives a complete list of all the writers on the subjects of antiseptics and disinfectants from 1669 to 1874. Those marked A are concerning the preservation of foods, (B) of woods, and (C) of bodies.

1859-64.	Academie hollandaise, B.	1854.	Baist, B.
1789.	Acrel, B.	1852.	Balard, C.
1846.	Ador, B.	1846.	Banner and Venzat, B.
1808.	Admiralty (English), B.	1856.	Barlow, B.
1860.	Armstrong, B.	1730.	Baster, B.
1837.	Annaberg (Society of), B.	1871.	Baudet, A.
1853.	Apelt, B.	1848.	Baudet, B.
1800(cir).	Appert, A.	1669.	Becher, C.
1838.	Ardoin, B.	1852.	Benda, B.
1839.	Aroza, B.	1838.	Bethell, B.
XI. Cen.	Avicenne, A.	1824.	Bill, B.

1858.	Blondin, A.	1859.	Dorsett, B.
1859.	Blythe and Dorsett, B.	1859.	Dorsett and Blythe, A.
1870.	Bonserret Gamgee, A.	1871.	Dubrunfaut, A.
1837.	Boucherie (Dr.), B.	1872.	Dumas (Institute)
1841.	Bourdon, B.	1846.	Dupre (Dr.), C.
1848.	Boutigny and Hutin, B.	1843.	Earl, B.
1825.	Braconnot, C.	1770.	Encyclopedie Economique, B.
1831.	Breant, B.	1740.	Fagot, B.
1848.	Brochard, B.		Fastier, A.
1847.	Brochard and Watteen, B.	1845.	Favrin, B.
1836.	Bronner, B.	1840.	Flesselle, B.
1835.	Brunel, B.	1837.	Flocton, B.
1844.	Burkes, B.	1851.	Fontaine-Moreau, C.
1838.	Burnett, B.	1852.	Fontenau, B.
1847.	Busse, B.	1852.	Fontenay (de), B.
1815.	Bowden, B.	1862.	Forestier (Ing.), B.
1810.	Cadet de Gassicourt, B.	1847.	Fournier-Caillet, B.
1818.	Callender, B.	1860.	Fragneau, B.
1829.	Carey, B.	1850.	Francois (Ing.), B.
1840.	Carney, B.	1825.	Fuchs, B.
1857.	Carthage, B.	1863.	Fumet-Dejort, B.
1867.	Cerio, A.	1845.	Fussey(de) and Pelletier, B.
1813.	Champy (Baron), B.	1837-41.	Gannal. A. C.
1815.	Chapmann, B.	1870.	Gamgee and Bonser, A.
1839.	Charpentier, B.	1848.	Gemini (de), B.
1800(cir).	Chaussier, C.	1847.	Giberton, B.
	Chemalle, B.	1637.	Glauber, A.
1833.	Chemnitz, B.		Goadby, C.
1832-36.	Chevalier, B.	1828.	Gossier, B.
1853.	Chevalier, C.	1837.	Gotthill, B.
1845.	Claudot, B.	1833.	Gouezon, B.
1865.	Cochinchinois, B.	1837.	Granville (Dr.), B.
1768.	Constable, B.	1801.	Grasmann, B.
1812-22.	Cook, B.	1856.	Grasset, B.
1859.	Cormier, A.	1846.	Grenon, B.
1824-47.	Cox, B.	1861.	Guibert, B.
1857-67.	Crepin, B.	1857.	Guyon (Dr.), B.
1818.	Dagneau, B.	1756.	Hales, B.
1853.	Dering, B.	1825.	Hancock, B.
	Desiccating Company, B.	1826.	Hartig, B.
1849.	Dickschen, B.	1874.	Hatzfeld, B.
1861.	Dingler's Journal, B.	1856.	Haut de Lassus, etc., B.
1821.	Dinsdale, B.		

1850.	Hochesaugt, B.	1848.	May, B.
1705.	Homborg, B.	1840-64.	Melsens (Prof.), B.
1848.	Hoene-Wronsky, B.	1844.	Mermet, B.
1772.	Hoelemann, B.	1851.	Meyer d'Uslar, B.
1824.	Houston, A.	1778.	Mignerou, B.
1874.	Hubert, B.	1847.	Millet, B.
1854.	Hugon, B.	1835.	Moll, B.
1848.	Hutin and Boutigny, B.	1846.	Monicault (de), B.
1767.	Jackson, B.	1825.	Monteith, B.
1855.	Jackson, B.	1866.	Morgan, A.
1855.	Jobart, A.	1841.	Muenzig, B.
1854.	Jousselin.	1822.	Newman, B.
1846.	Knab, B.	1826.	Newmarch, B.
1825.	Knowles, B.	1805.	Nystrom, B.
1821. (?)	Knowles and Davy, B.	1825.	Oxford, B.
1823.	Kyan, B.	1779.	Pallas, B.
1822.	Lacroix, B.	1821.	Parkes, B.
1847.	Lafollie, B.	1843.	Parkes, B.
1809.	Landwirthschaftliche, B.	1820.	Pasley, B.
1826.	Langton, B.	1865.	Pasteur (de l' Institut), A.
1862.	Lapparent (de), B.	1835.	Payen (?), B.
1814.	Lambert, C.		Payen
1853.	Le Chatleir, B.	1846.	Payn, A.
1848.	Lecour, B.	1843.	Payn, B.
1857.	Lege & Fleury-Pironnet B.	1857.	Peligot (Prof.), B.
		1806.	Perkins, B.
1847.	Lemaitre de Rabodanges, C.	1872.	Petit, C.
		1846.	Petit, B.
1857.	Lemattais, etc., A.	1861.	Petitjean, B.
1837.	Letellier, B.	1818.	Philosophical Magazine, B.
1846.	Levalley-Duperron, B.	1844.	Pigne, C.
1839.	Levien, B.	1866.	Pienkowski, C.
? ?	Lignac (de), A.	1850.	Pollack, B.
1811.	Lukin, B.	1841.	Pons, B.
1824.	Luscombe, B.	1822.	Prechlt, B.
1830.	Mackensie, A.	1848.	Quatrefages, B.
1805.	Mackonochie, B.	1872.	Rabuteau and Papillon, C.
1864.	Manes, B.	1818.	Raimond, C.
1841.	Margary (Loyd), B.	1845.	Ransome, B.
1830.	Marolles (Cte de), B.	1852.	Raspail, C.
1828.	Marsh, B.	1855.	Real, B.
?	Masson, A.	1833.	Recueil Industriel, B.
1838.	Mathias-Mayor, C.	1740.	Reed, B.

1866.	Redwood, A.	1834.	Strutzki, B.
1846.	Renard-Perrin, etc., B.	1854.	Sucquet, C.
1829.	Reybey, B.		Sweeney, A.
1862.	Robert (de), B.	1832.	Tauffier, C.
	Robin, C.	1861.	Technologiste (le), B.
1822.	Roquin, B.	1872.	Tellier, A.
1862.	Rottier, B.	1846.	Testud de Beauregard and Renard-Perrin, B.
1845(cir.)	Sace (Dr.), A.		
1845.	Saint (de), B.	1856.	Thellier-Verrier, B.
1845-48	Saint-Preuve, B.	1855.	Theroulde, C.
1772.	Salberg, B.		Thwaites, C.
1825.	Samson, A.	1844.	Tissier, B.
1820.	Sanderson, B.	1829.	Toursel, C.
1820.	Sargent, B.	1838.	Treffy, B.
1824.	Schmidt, C.	1846.	Venzat and Banner, B.
1851.	Schweppe, B.	1854.	Vendeil, A.
1856.	Schweppe and Trottier, B.	1852.	Videgrain, B.
1815.	Semple, B.	1848.	Violette, B.
1845.	Silvestri, C.	1858.	Vohl (Dr.), B.
1822.	Societe d'Encouragement, B.		Vulpian, C.
	Sloper, A.	1848.	Warington, A.
1830.	Soubeyran, C.	1847.	Watteen and Brochard, B.
1854.	Souverain, A.	1824.	Watterton, B.
1832.	Starling-Benson, B.	1847.	Watterstedt, B.
1831.	Stevenson, B.	1798.	White, B.
1848.	Stœckhardt,	1798.	Wolmeister, B.
		1850(cir.)	Wright (Dr.), B.

In addition to the previous list the following books, treating especially of the preservation of the dead and kindred subjects, should be added:

The Art of Embalming.—Thos. Greenhill, London, 1705.

A History of Egyptian Mummies, etc.—J. T. Pettigrew, London, 1834.

An Essay on Egyptian Mummies, etc.—A. B. Granville.

Description of an Egyptian Mummy, with an Account of the Operation of Embalming, etc.—J. C. Warren, Boston, 1838.

Treatise on Creosote, with Considerations on the Embalment of the Egyptians.—J. R. Cormack.

Rawlinson's Herodotus.—Vol. II., page 141.

Anatomia Reformata, Concinna Corporis Humana, etc.—Stephen Blacardus, 1687.

Methodus Balsamundi Corpora Humana, aliaque Majora, sine Evisceratione. Gab. Clauderus.

De Conditura, seu, ut vulgo, loquuntur, de Balsamatione Cadaverum Humanorum.—J. D. Wilvisshiem, Argent. 1869.

Græcorum Extispiciis.—Cornelius Cuntz, Gottingen, 1826.

Traite des Embaumements.—Louis Penicher, Paris, 1669.

Manuel d'Anatomie, etc.—J. N. Marjolin, M. D. Paris, 1815.

Traite de la Parfaite Method Embaumer les Corps.—James Guillemeau. Paris, 1609.

Traite des Embaumements.—Gannal. Paris, 1838.

Das Einbalsameln des Leichen.—Magnus. Brunswick, 1839.

The Art of Embalming, etc.—Thos. Gardner.

Conservation des Bois et de diverses Matieres Organiques.—Paulet.

Sepulture and its Methods.—S. Wickes. Philadelphia, 1884.

The Undertakers' Manual.—August Renouard.

Treatise on Embalming.—Lessley. Toledo, 1884.

Text Book on Embalming.—Clark. Springfield, 1886.

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Strange Burial Orders. All the Year Round, XLI—255.

Burial Places and Burial. S. E. Bishop. West. Lit. J., 1—401.

Barbarous Burial. Sharp, 8—70. 9—33.

Burial Practices. Modern Review, 164—299.

Burial Vagaries. Chambers' Journal, XLIX—673.

Burials. G. Hill. Sharpe, 34—97.

Burial Places. W. Mitchell. Lippincott, XIX—590.

Burial Places and Wakes. Penny Magazine, 13—179—283.

In Ancient Rome. Am. Arch., 4—127.

Heathen and Christian Burial. Household Words, 143.

The Last Homes. F. Talbot. Belgravia, vol. 27—100.

Pagan and Christian Sepulchers. The Living Age, vol. 86, page 481.

The Silent Majority. J. H. Brown. Harper, 49—468.

Simple and Sanitary Burial. S. P. Day. Victoria Magazine, vol. 32, page 576; vol. 33, pages 272—275.

Burial Customs. D. W. Cheever. North American, 93—108.

Burial Customs and Obituaal Law. Mrs. A. D. Garrick. National Quarterly, vol. 4, page 63.

Burial in Scotland. Chambers' Journal, 25—204.

Burial Eccentricities. Chambers' Journal, 54—593.

Burial. R. H. Vickers. Once a Week, vol. 9, page 635.

Burial. J. Brasher. Christian Examiner, vol. 31, pages 137—281.

Ancient Graves and Their Contents. National Quarterly, vol. 22, page 315.

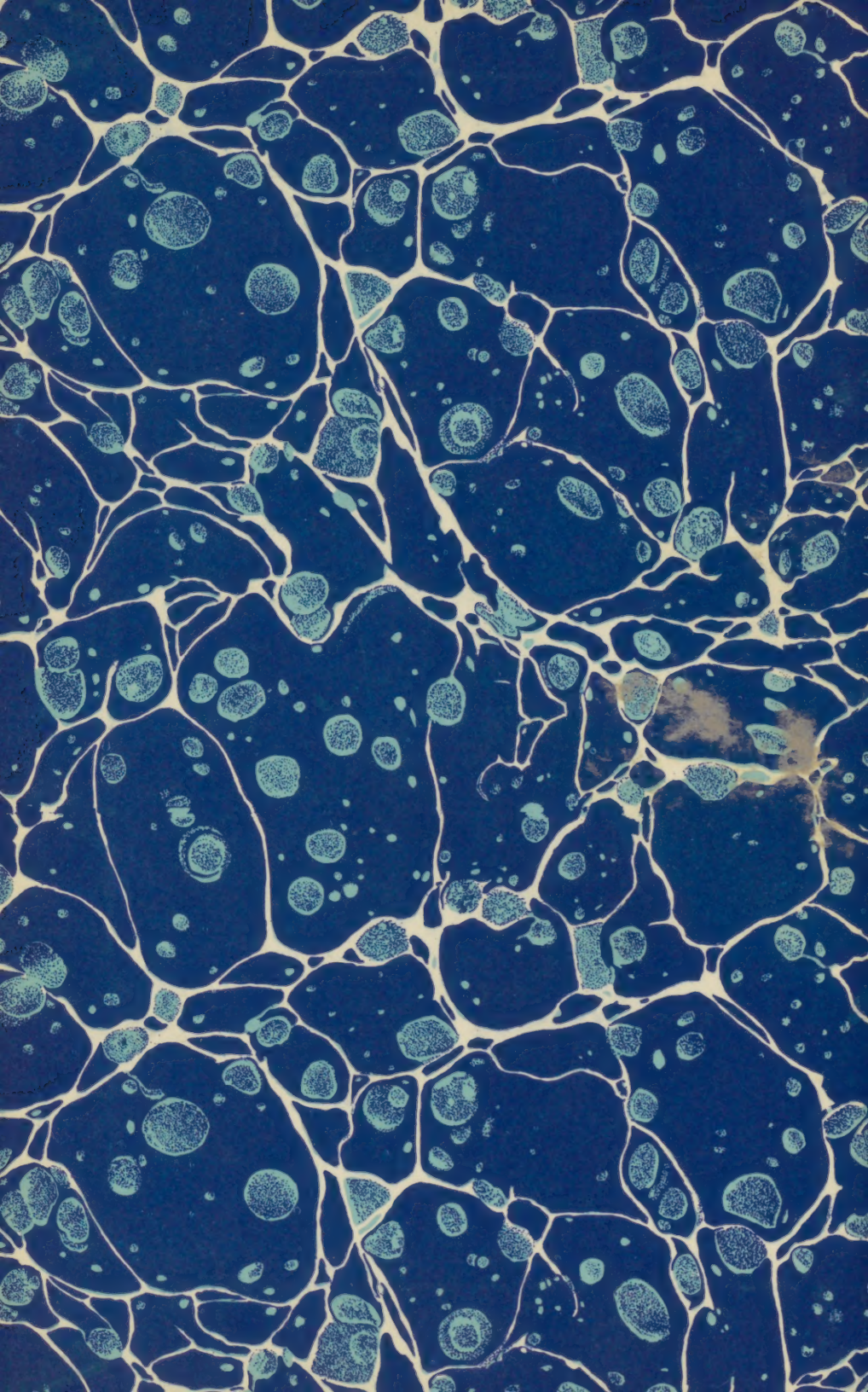
Burial and Burning in the East. F. R. Feudge. Lippincott's, vol. 13, page 593.

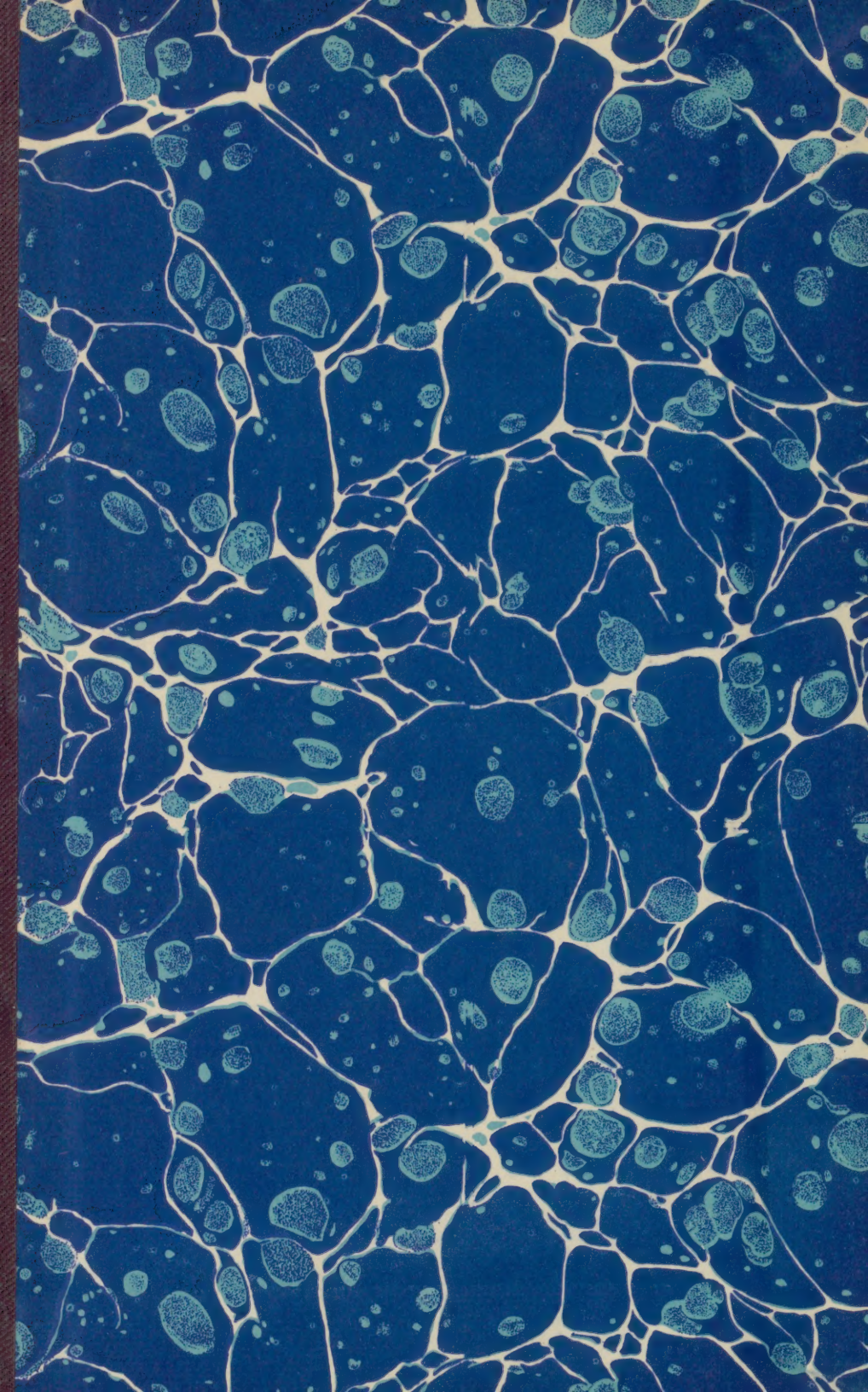
A Day with the Dead. M. A. Dodge. Atlantic, vol. 6, page 326.

Disposal of the Dead. B. W. Richardson. Popular Science Review, vol. 14, page 592.

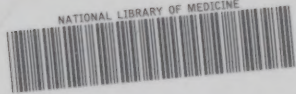
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